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GEOLOGY.—*The Geological Society of Washington.*[1] ROLAND W. BROWN, U. S. Geological Survey.

Until the organization of the Geological Society of Washington on February 25, 1893, the geologists of Washington and vicinity had no adequate outlet for full discussion of their mutual geological interests and studies. The Philosophical Society, founded in 1871, provided opportunity for only an occasional paper on a geological subject. Consequently, realization of this need early in 1893 precipitated a call, signed by 25 persons, for a meeting to consider the advisability of creating a geological society. This meeting, attended by 23 persons, was held on Tuesday, February 21, in the office of C. D. Walcott, Director of the United States Geological Survey, then located in the Hooe Building on the south side of F Street midway between 13th and 14th Streets, NW., about where the Capitol Theater now stands. The group decided unanimously to organize a society and, after appointing a committee, consisting of C. D. Walcott, chairman, J. S. Diller, secretary, S. F. Emmons, W. H. Holmes, and G. P. Merrill, to prepare a constitution and bylaws, selected Saturday, February 25, for the organization meeting. This meeting was also held in the office of Director Walcott, with 50 persons present. A constitution and bylaws were adopted and the following officers were elected: President, C. D. Walcott; Vice-Presidents, S. F. Emmons, W. H. Holmes; Secretaries, Whitman Cross, J. S. Diller; Treasurer, Arnold Hague; Members-at-large of the Council, G. F. Becker, T. M. Chatard, G. H. Eldridge, G. K. Gilbert, G. P. Merrill. The purpose of the Society was stated to be "the increase and diffusion of geological knowledge."

The first regular meeting was held on Wednesday, March 8, with 49 persons present, in the basement of the Cosmos Club at Madison Place and H Street, NW. Maj. J. W. Powell opened the program with a review of the advance of geology in the United States as influenced by the work of the geological surveys in the West under government auspices. Then H. W. Turner spoke on "The Structure of the Gold Belt of the Sierra Nevada" and S. F. Emmons on "The Geological Distribution of the Useful Metals." By this date 109 persons had signed the constitution and, according to a resolution adopted by the Society, were entitled to enrollment as founders—upon payment of dues, $2 for active and $1 for corresponding membership.

With relatively few exceptions all subsequent meetings until May 1952 were held at the Cosmos Club at Madison Place and H Street, first in the basement, then in the renovated carriage shed that was euphemistically called the Assembly Hall. Since October 1952 the meetings have been held at the new location of the Cosmos Club at Massachusetts and Florida Avenues, NW.

At the annual meeting on December 13, 1893, with 20 persons present, the secretary reported a total of 134 members, 112 active and 22 corresponding. The treasurer reported receipts of $177 and disbursements of $79.17, leaving a balance of $97.83; but 30 members, about 23 per cent of the membership, had not paid their dues! For this there were, doubtless, extenuating circumstances. It will be recalled that on March 4, 1893, Grover Cleveland became President

[1] Publication authorized by the Director, U. S. Geological Survey. This paper contains the substance of an informal communication, celebrating the sixtieth anniversary of the Society at the 723d meeting, February 25, 1953.

(for the second time), and Adlai E. Stevenson, Vice-President of the United States. Not because of these men but in spite of them, the clamor, particularly by westerners, for the free and unlimited coinage of silver, the unchecked speculation in dubious enterprises, and the unfavorable foreign trade balance caused normal business to be very cautious. Production fell off. One bank after another failed until more than 400 had collapsed, spreading much distress across the land. This was the Panic of 1893, and its tight money very likely had much to do with the nonpayment of dues by some of the founding fathers of the Society. Nevertheless, after things leveled off, and after a courteous lapse of time, the list of founders on February 28, 1895, as published in the proceedings of the Society, totaled 98. Of all these, according to present information, the only living founder is T. W. Stanton, now 92 years old.

Sixty years have passed since the Society was founded. The twenty-fifth anniversary was unobserved because that came during war conditions in 1918 when many members were not in Washington and only one meeting a month was held. The fiftieth anniversary was celebrated appropriately on February 24, 1943. President Herbert Insley called on the attending founders and some of the older members for reminiscences. T. W. Stanton told about the telephone call inviting the paleontologists working at the National Museum to the first meeting to consider organization of a society; and also recalled, as he humorously put it, how he and F. H. Knowlton in the early 1900's had solved the Laramie problem! George Steiger showed pictures of the old U. S. Geological Survey chemical laboratory in the F Street building and said that when Survey funds had been cut 50 per cent and personnel was being reduced during the depression of 1893, F. W. Clarke was retained because he was the best chemist and he, Steiger, was kept because he received the least money. W. C. Mendenhall remembered his awe in the presence of Gilbert, Powell, and Dutton. T. W. Vaughan related stories about Gilbert and others. G. W. Stose had lantern slides showing pictures of Walcott, Powell, and others. Finally, Arthur Spencer said dryly that he also could tell stories about the "old boys" but that he considered such to be inappropriate at that time! At the close of the meeting, beer, cider, doughnuts, and pretzels were served.

Condensed proceedings of the Society for the first years were published by the Society. At the turn of the century the programs began to be reported fairly regularly in *Science*; and from 1911 to 1949, with a few interruptions, they were published in the *Journal of the Washington Academy of Sciences*. Some of these proceedings are to be found in bound volumes on the shelves of the Library of the U. S. Geological Survey. Deposited there also are some of the books containing the secretarial minutes.

How shall the worth of the Society and its activities during the past 60 years be appraised? First, the Society has provided the opportunity for a stimulating fellowship of younger with older geologists. Second, the Society has cooperated with other groups, such as being host to the Geological Society of America when that organization has held its annual meeting in Washington. In 1898 the Society became affiliated with the Washington Academy of Sciences, with which it has sometimes held joint meetings. Third, through the faithful performance of duties its officers have provided a long succession of instructive, and nearly always lively, programs. These cannot be analyzed here seriatim, but the list of presidential addresses at the annual meetings in December gives a cross section of the kind and scope of subject matter that has been discussed. In this list, an asterisk (*) after a name indicates a founder. If the address was given at some other time than the annual meeting, that date is given. If known, the place of publication is cited.

PRESIDENTS OF THE SOCIETY AND THEIR ADDRESSES

1893, 4. C. D. Walcott.* The United States Geological Survey. (Pop. Sci. Monthly **46**: 479–498. 1895.)

1895. G. K. Gilbert.* The origin of hypotheses. (Science **3**: 1–13. 1896.)

1896. S. F. Emmons.* The geology of government explorations. (Science **5**: 1–15, 42–51. 1897.)

1897, 8. Arnold Hague.* Early Tertiary vol-

canoes of the Absaroka Range. (Science **9:** 425–442. 1899.)

1899, 0. WHITMAN CROSS.* The development of systematic petrography in the nineteenth century. (Journ. Geol. **10:** 332–376, 451–499. 1902.)

1901, 2. J. S. DILLER.* The wreck of Mt. Mazama. (Science **15:** 203–211. 1902.)

1903, 4. C. W. HAYES.* Should there be a Federal department of mines?

1905, 6. G. P. MERRILL.* Development of the glacial hypothesis in America. (Pop. Sci. Monthly **68:** 300–322. 1906.) The composition and structure of meteorites compared with those of terrestrial rocks. (Amer. Journ. Sci. **27:** 469–474. 1909.)

1907, 8. WALDEMAR LINDGREN.* Present tendencies in the study of ore deposits. (Econ. Geol. **2:** 743–762. 1907.)

1909. GEORGE O. SMITH. Scientific by-products of applied geology. April 13, 1921. (Journ. Eng. and Min. **111:** 66–67. 1921; Journ. Washington Acad. Sci. **11:** 203–207. 1921.)

1910. M. R. CAMPBELL.* Review of theories regarding origin and accumulation of oil. (Econ. Geol. **6:** 363–395, 812. 1911.)

1911. ALFRED H. BROOKS. Applied geology. (Journ. Washington Acad. Sci. **2:** 19–48. 1912.)

1912. T. W. STANTON.* Some variations in Upper Cretaceous stratigraphy. (Journ. Washington Acad. Sci. **3:** 55–70. 1913.)

1913. F. L. RANSOME. Tertiary orogeny of the North American Cordillera and its problems. (Problems of American geology: 287–376. 1915.)

1914. ARTHUR KEITH.* Main features of Appalachian structure. (Bull. Geol. Soc. Amer. **34:** 309–380. 1923.)

1915. T. W. VAUGHAN. Some problems in the geologic history of the perimeters of the Gulf of Mexico and the Caribbean Sea.

1916. ARTHUR SPENCER. Stream terraces in the Rocky Mountain province.

1917. W. C. MENDENHALL.

1918. F. H. KNOWLTON.* Evolution of geologic climates. (Bull. Geol. Soc. America **30:** 499–566, 1919.)

1919. E. O. ULRICH. Major causes of land and sea oscillations. (Journ. Washington Acad. Sci. **10:** 57–78. 1920.)

1920. DAVID WHITE.* Deposition of oil shales. April 13, 1921.

1921. G. W. STOSE. Relation of faults to folds in the Appalachians.

1922. W. C. ALDEN. Physiographic development of the northern Great Plains. (Bull. Geol. Soc. Amer. **35:** 385–423. 1924.)

1923. G. F. LOUGHLIN. The development and outlook of economic gelogy.

1924. F. E. WRIGHT. Methods for relative gravity measurements.

1925. L. W. STEPHENSON. Major features in the geology of the Atlantic and Gulf Coastal Plain. (Journ. Washington Acad. Sci. **16:** 460–4£0. 1926.)

1926. N. H. DARTON.* Erosion planes and overlaps in the eastern Maryland region. December 12, 1934.

1927. CHARLES BUTTS. Variations in Appalachiah stratigraphy. (Journ. Washington Acad. Sci. **18:** 357–380. 1928.)

1928. D. F. HEWETT. A review of European metal production.

1929. S. R. CAPPS. Glaciation in Alaska. (U. S. Geol. Surv. Prof. Paper **170:** 1–8. 1931.)

1930. G. R. MANSFIELD. Problems of the Phosphoria formation in the Rocky Mountains. (Econ. Geol. **26:** 353–374. 1931.)

1931. O. E. MEINZER. History and development of ground water hydrology. (Journ. Washington Acad. Sci. **24:** 6–32. 1934.)

1932. F. E. MATTHES. The evolution of the glacial cirque.

1933. C. N. FENNER. Some magmatic problems. (Journ. Washington Acad. Sci. **24:** 113–124. 1934.)

1934. H. G. FERGUSON.

1935. W. T. SCHALLER. A mineralogist ventures in geology.

1936. M. I. GOLDMAN. Petrographic features of salt dome cap rock.

1937. R. C. WELLS. Present trends in geochemistry. (Journ. Washington Acad. Sci. **28:** 415. 1938.)

1938. H. D. MISER. Our petroleum supply. (Journ. Washington Acad. Sci. **29:** 93–109. 1939.)

1940. J. T. PARDEE. Unusual currents in glacial Lake Missoula. (Bull. Geol. Soc. Amer. **53:** 1569–1599. 1942.)

1941. J. B. REESIDE, JR. Upper Cretaceous sediments of the western States. (U. S. Geol. Surv. Oil and Gas Inv. Prelim. Map 10. 1944.)

1942. C. S. ROSS. Clays and soils in relation to geologic processes.

1943. HERBERT INSLEY. Contact deposits in an artificial silicate magma. (Journ. Washington Acad. Sci. **35:** 156–161. 1945.)

1944. GEORGE TUNELL. Some thermodynamic and leptologic threads in the geologic tapestry.

1945. L. W. CURRIER. Granitization as a regional metamorphic process in New England. (Journ. Washington Acad. Sci. **37:** 75–86. 1947.)

1946. W. H. BRADLEY. Limnology and the Eocene lakes of the Rocky Mountain region. (Bull. Geol. Soc. Amer. **59:** 635–648. 1948.)

1947. W. P. WOODRING. Central America land bridge and sea land.

1948. W. W. RUBEY. The problem of changes in composition of sea water and atmosphere during the geologic past. (Bull. Geol. Soc. Amer. **62**: 1111–1148. 1951.)
1949. J. S. WILLIAMS. Boundaries between geologic systems, illustrated by Paleozoic examples.
1950. L. H. ADAMS. Orbis terrarum: a century of progress.
1951. A. N. SAYRE. Our water supply.
1952. JOSIAH BRIDGE. The extent and significance of the post-Lower Ordovician discontinuity.
1953. ARTHUR A. BAKER.

PALEONTOLOGY.—*A new pelecypod genus from Upper Triassic strata in Peru.*[1]

DAVID NICOL and WILLIAM T. ALLEN, U. S. National Museum.

Dr. R. W. Imlay, of the U. S. Geological Survey, showed the senior author a collection of fossils from the Atacocha Mine near Cerro de Pasco, Peru. Among the material were six valves of a peculiar species of pelecypod which Dr. Imlay thought might belong to the genus *Tutcheria* Cox, 1946. After four of the specimens were prepared, it became obvious that this material represented an undescribed genus which seems to be most closely related to the family Cardiniidae.

Family CARDINIIDAE Zittel, 1881

Isopristes Nicol and Allen, n. gen.

Type species.—*Isopristes crassus* Nicol and Allen, n. sp.

Description.—Shell thick, porcellaneous(?); valve outline subquadrate, elongate, of slight convexity; no escutcheon or lunule, although area below beak has small but deep depression; no apparent gape; beaks prosogyrate, located nearly at anterior end of dorsal border; ornamentation consisting of gentle concentric folds which are steeper at the ventral side and appear to be resting stages of growth; radial ornamentation consisting of many small, closely spaced ribs; interior margin has small but well-marked crenulations; anterior adductor muscle scar small, nearly round, deep and located below the anterior end of the hinge; posterior adductor muscle scar twice as large but not so deeply indented, located below the posterior end of the hinge plate; pallial line distinct, integripalliate (musculature much like that of the trigoniids).

The hinge, unfortunately, is imperfectly preserved in all specimens. The most striking feature is the well-marked ridges on the sides of the teeth, which are like those of *Trigonia* except that the ridges are much farther apart, larger, and more rounded. The preserved part of the hinge is like that of the unionids or cardiniids. On the left valve there is an elongate tooth which is nearly parallel to the dorsal border. The anterior end of this tooth is just behind the beak. At its forward extremity it is joined with another tooth which is shorter and nearly perpendicular to the dorsal border. Anterior to this latter tooth is a wide flat area, and at the anterior end of the hinge plate are two small teeth which nearly surround a socket. The right valve has one prominent tooth which fits in the socket between the two prominent elongate teeth of the left valve. There also appears to be one small round tooth on the anterior portion of the hinge plate. The hinge plate of *Isopristes* is much more massive than that of the trigoniids and is more like some of the unionids and cardiniids. There is a groove behind the umbo and below the dorsal margin which may have lodged the ligament. Whether the ligament was external or internal cannot be ascertained.

Comparisons.—*Isopristes* resembles some of the genera included in the family Cardiniidae. Unfortunately, the family is not well defined, and its relationship to other groups is not well understood. *Isopristes* most closely resembles *Cardinia* Agassiz, 1841, in outline position of beaks, and some aspects of the hinge, but differs from it in having radial ribs and a crenulated interior margin. *Pachycardia* Hauer, 1857, has an outline and hinge that somewhat resemble *Isopristes* but differs from it in the absence of radial ribs, absence of crenulations on the interior margin, and the presence of a lunule. In outline and position of the beaks *Isopristes* is also similar to *Pinzonella* Reed, 1932, from the Triassic of Brazil; however, *Pinzonella* differs from *Isopristes* in having a posterior ridge on the exterior of the shell and in not having radial ornamentation

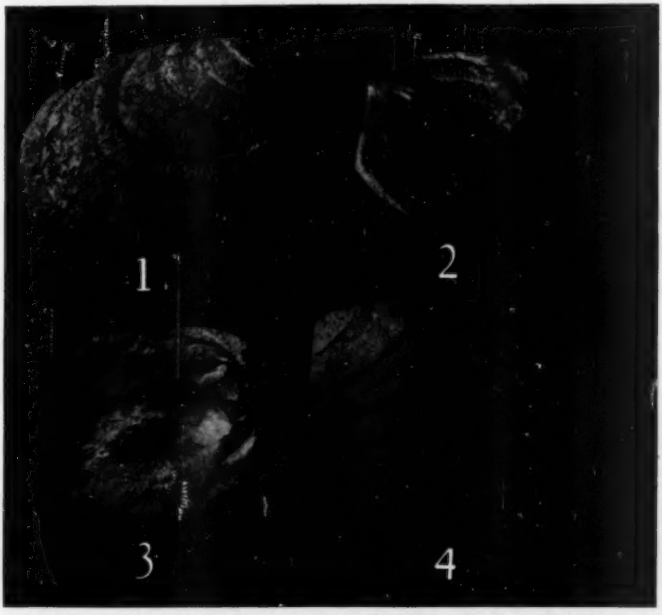
[1] The authors greatly appreciate the help of Dr. R. W. Imlay, of the U. S. Geological Survey, for allowing us to work on the material and giving us helpful suggestions on locality and literature data. R. F. Johnson, of the U. S. Geological Survey, gave us additional locality information.

and crenulations on the interior margin. The hinge and outline of *Pinzonellopis* Mendes, 1944, also from the Triassic of Brazil, are somewhat like those of *Isopristes*, but *Pinzonellopis* differs from it in having the beak near the center of the dorsal border and in not having radial ribs and a crenulated interior margin. *Isopristes* also resembles some species of *Paleocardita* Conrad, 1867, although it has no lunule, and its hinge is different.

Isopristes crassus Nicol and Allen, n. sp.

Figs. 1–4

Description.—Shell thick, porcellaneous(?); valve outline subquadrate, dorsal and anterior borders nearly straight, ventral margin gently rounded, posterior border broadly arched; ornamentation consisting of six to eight concentric folds which appear to be resting stages of growth and are steeper on ventral side; radial ornamentation consisting of numerous small, rounded, closely-spaced radial ribs; anterior, ventral, and posterior interior margins have numerous small closely spaced crenulations; lunule and escutcheon apparently absent, but a small and deep depression present under beaks; beaks prosogyrate, located at anterior end of dorsal margin; anterior adductor muscle scar small, round, deep, situated below anterior end of hinge plate; posterior adductor scar larger, not so deep, located below posterior end of hinge plate; pallial line integripalliate, well marked, located far from margin of shell; hinge plate high and well developed; left valve has one elongate tooth which is nearly parallel to dorsal margin and terminates under beak; tooth has coarse schizodont projections on ventral side; this tooth is connected with a shorter one at anterior end; the second tooth has few schizodont projections on dorsal side, and is nearly perpendicular to hinge plate; wide flat area present between the shorter tooth and a socket which appears to be almost surrounded by two small teeth located near anterior end of hinge plate; details of this part of hinge not well preserved. Right valve appears to have two teeth; one somewhat elongate, fits between



FIGS. 1–4.—*Isopristes crassus*: 1, Exterior view of right valve, paratype, U. S. N. M. no. 108692a; 2, interior view of part of right valve, paratype, U. S. N. M. no. 108692b; 3, interior view of part of left valve, holotype, U. S. N. M. no. 108691; 4, exterior view of left valve, paratype, U. S. N. M. no. 108692. All figures × 1. All specimens are from Upper Triassic (Noric Stage); Atacocha Mine, 34 km northeast of Cerro de Pasco, Peru.

the two large teeth of left valve; the other tooth is small and round, fits into socket at anterior end of hinge plate of left valve; hinge of right valve not so well preserved as that of left valve.

Measurements in mm.—Some specimens are too incomplete to be measured accurately.

	Height	Length	Convexity (one valve)
Holotype 108691			12.2
Paratype 108692	35.3	49.3	16.7
Paratype 108692a	29.3	44.6	11.7
Paratype 108692b	27.3		10.7

Comparisons.—*Isopristes crassus* most closely resembles *Unio crassissimus* Sowerby, 1817, and *Unio listeri* Sowerby, 1817, but it differs from both these species in having a crenulated interior margin and radial ribs.

Types.—Holotype, left valve, U. S. N. M. no. 108691; five paratypes, four right valves and one left valve, U. S. N. M. no. 108692.

Age.—According to Dr. R. W. Imlay (oral communication) the bed in which *Isopristes crassus* was found is Upper Triassic (Noric Stage).

Locality.—U. S. Geological Survey locality no. 24388; Atacocha Mine, 16 km by airline (34 km by road) northeast of Cerro de Pasco, Department of Pasco, Atacocha District, Peru. The fossils came from the north side of Quebrada Chicrin, 215 meters N.85°E. from the portal of the 4,000-meter level of the Atacocha Mine.

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ENTOMOLOGY.—Hollandipsylla neali, *a new genus and new species of flea from North Borneo, with comments on eyeless fleas (Siphonaptera).* ROBERT TRAUB, Lt. Col., M.S.C., Department of Entomology, Army Medical Service Graduate School, Washington, D. C.[1]

A new genus of ceratophyllid flea was among the distinctive ectoparasites collected in North Borneo during investigations on arthropod vectors and rodent reservoirs of disease conducted by a joint U. S. Army–British Colonial Office Medical Research Unit in July and August 1951. This new genus, collected from a flying squirrel, is described and illustrated below.

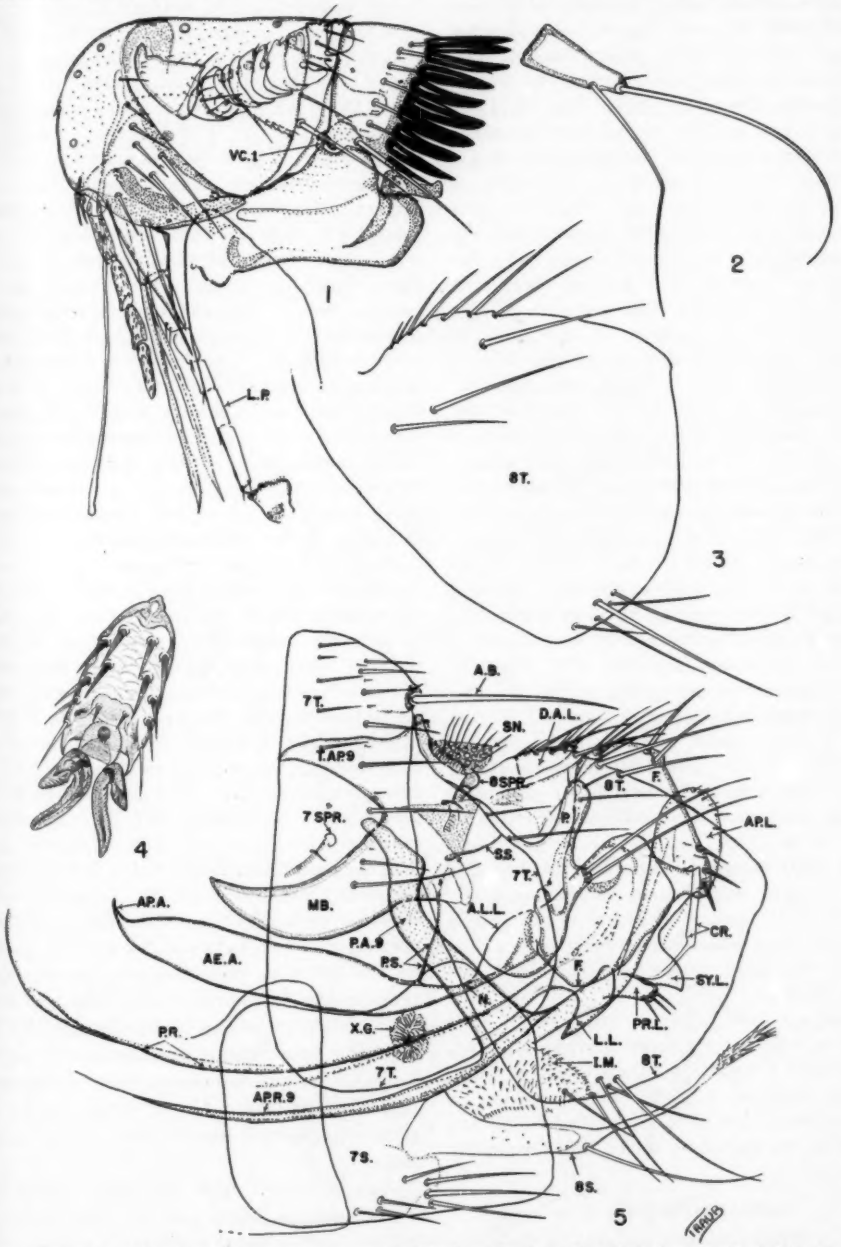
Hollandipsylla, n. gen.

Unique among squirrel fleas of the subfamily Ceratophyllinae in being eyeless and in possessing only three pairs of lateral plantar bristles on the last segment of the tarsi, two proximal pairs being displaced mesad.

Caput integrecipit. Eye completely vestigial. Pre-antennal region with two rows of bristles. Frontal tubercle small. Postantennal region with but one complete row of bristles and that marginal. Antennal segment II with bristles short in male, not reaching beyond proximal fourth of club; in female, extending beyond middle of club. Antennal groove extending onto propleuron in male. Labial palpi subequal in length to forecoxae. First vinculum or link plate (Fig. 1, *VC. 1*) received in distinct sinus of prosternosome; second and third vincula well developed; fourth

[1] The illustrations were prepared by the author, with the exception of Fig. 4, which was drawn by Thomas Evans, of the Department of Entomology, Army Medical Service Graduate School, to whom I am indebted.

absent. Pronotal comb consisting of about 11–13 spines on a side; spines typically about as long as pronotum. Pronotum with one row of long bristles. Dorsolateral bristles of tibiae mainly paired, and of unequal length; "tibial comb" therefore lacking. Procoxae with many lateral bristles



FIGS. 1–5.—*Hollandipsylla neali*, n. gen., n.sp.: 1, Head, male; 2, anal stylet, female; 3, eighth tergum, male; 4, fifth segment of male hind tarsus; 5, modified abdominal segments, male.

scattered over length of segment; other coxae with very few such bristles and these marginal or submarginal; mesal bristles virtually absent. Profemora lacking lateral, nonmarginal bristles. Lateral metanotal area (Fig. 9, *L.M.*) distinct. Lacking a pleural arch, i.e., pleural ridge of metasternosome not fitting into a socket. The skeletal sclerotization formed by dorsal ridge of lateral metanotal area and the pleural ridge extending dorsad into metanotum but becoming weakly sclerotized before reaching dorsal region of metanotum. Metanotum and some of typical abdominal terga with apical spinelets. Metepisternum lacking a squamulum. Meso- and metanotum and unmodified abdominal terga with two rows of bristles. First segment of hind tarsus subequal in length to II and III. Fifth segment of all tarsi bearing only three pairs of lateral bristles; with two proximal pairs displaced towards midline (Fig. 4). Mesotarsal segment V relatively broad, only about twice as long as broad. Typical abdominal spiracles small; on anterior segments resembling a flattened ovoid. Small apical teeth present on anterior abdominal terga. Male with one antesensiliary (antepygidial) bristle, female with three or four. Eighth sternum reduced to a long narrow structure which is produced apically into an elongate filamentous process. Distal arm of male ninth sternum with a subacute secondary proximal lobe (Fig. 11, *SY.L.*). Lateral lobes of aedeagus (Fig. 10, *L.L.*) well developed and extending proximad of proximal lobes of distal arm of ninth sternum. Crochets (*CR.*) fairly large but weakly sclerotized; apically subtruncate. Movable finger of digitoid bearing spiniforms. Penis rods uncoiled (Fig. 5, *P.R.*). Anal stylet (Fig. 2) with an apical and also a ventromarginal long bristle. Ventral anal lobe rounded, not angulate. Bursa copulatrix (Fig. 6, *B.C.*) apically subglobose and with a long vermiform subacute duct. Spermatheca (Fig. 7, *SP.*) with head much longer than broad, and longer than tail.

Genotype.—Hollandipsylla neali, n. sp. The genus is named for George P. Holland, head, Systematic Entomology, Department of Agriculture, Ottawa, Canada, whose studies on Siphonaptera have been truly outstanding and to whom his coworkers in the field are greatly indebted.

Hollandipsylla neali, n. sp.

Types.—Holotype male and allotype female, ex *Hylopetes* sp., a small flying squirrel, North Borneo, Mt. Kinabalu, Tenompok, elevation 5000 ft.; collected by R. Traub, 1951; host collected by D. H. Johnson. No other specimens known. Types deposited in U. S. National Museum.

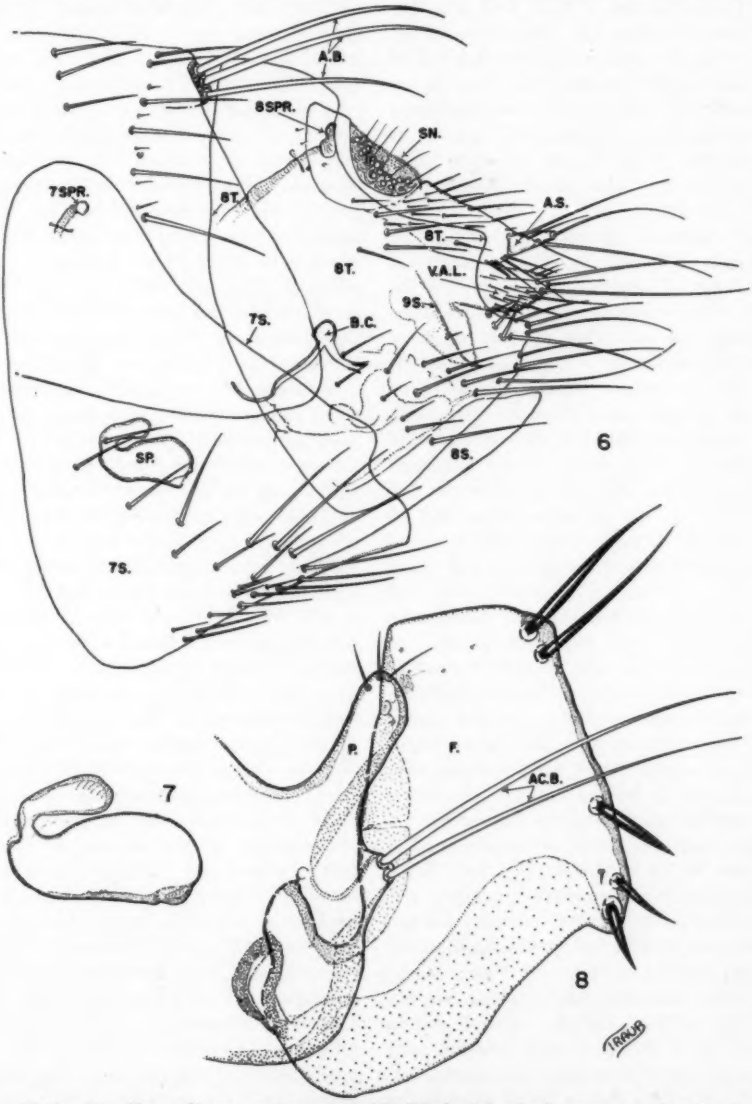
Head (Fig. 1).—Pre-antennal region with a posterior row of three bristles preceded by a row of about five or six much smaller bristles, of which the upper two or three in the male border the antennal groove. Eye completely vestigial, inapparent. The genal process subacute. Labial palpi five-segmented, reaching nearly to apex of forecoxae. Maxillary palpi with second segment subequal to first in length; palpi extending to about level of apex of third segment of labial palpi. Scape of antenna with marginal short bristles. Second antennal segment with apical bristles short in male, not reaching beyond apex of third segment; in female some of these bristles reaching to level three-quarters length of club. Postantennal region with a long bristle above midpoint of dorsal margin of antennal groove and with a caudomarginal row of bristles; ventralmost of row by far the longest; with a series of very short bristles in one or two longitudinal rows delimiting border of antennal groove.

Thorax.—Pronotum with a row of about seven bristles per side; with a comb of about 10 or 11 spines on a side in the male, 12 or 13 in the female; the spines fairly straight or slightly concave. Most spines slightly longer than pronotum is broad, as measured from anterior margin to base of spine. Mesonotum (Fig. 9, *MSN.*) with two rows of bristles. Mesonotal flange on each side with two or three pseudosetae (*PS.S.*). Mesepisternum (*MPS.*) with four or five fairly long bristles. Mesepimere (*MPM.*) with about seven such bristles, of which three long ones are in a horizontal line slightly below level of third vinculum. Metanotum (*MTN.*), together with its flange, as long as mesonotum; flange with one dorso-apical tooth. Lateral metanotal area (*L.M.*) slightly less than twice as long as broad; with three or four bristles, of which those near posterior margin are longest. Metepisternum (*MTS.*) with one long bristle in posterodorsal region flanked by one or two shorter ones. Metepimere (*MTM.*) with about six or seven bristles in three rows. Spiracle here is a short, oblate spheroid.

Legs.—Profemur with one fairly long apical ventromarginal bristle and two such proximal bristles; lacking lateral nonmarginal bristles; with only one mesal nonmarginal bristle; mesofemur

the same; metafemur quite similar but with an additional small ventromarginal subproximal bristle and lacking the mesal one. Protibia with stout dorsomarginal bristles arranged as follows: 1-2-2-2-1-2-2; mesotibia: 1-2-2(1 in female)-2-1-2-2; metatibia: 1-2-1-2-2-1-2-2. In mesotarsus, third segment with a distal bristle which extends beyond apex of fourth; in metatarsus this bristle merely reaching apex of fourth. Measurements (in microns) of tibiae and segments of tarsi (petiolate base deleted) of holotype as follows:

Leg	Tibia	Tarsal Segments				
		I	II	III	IV	V
Pro-	188	70	64	62	47	105
Meso-	317	141	118	82	59	112
Meta-	398	376	236	141	87	130



FIGS. 6–8.—*Hollandipsylla neali*, n. gen., n. sp.: 6, Modified abdominal segments, female; 7, spermatheca; 8, process and digiloid of male clasper.

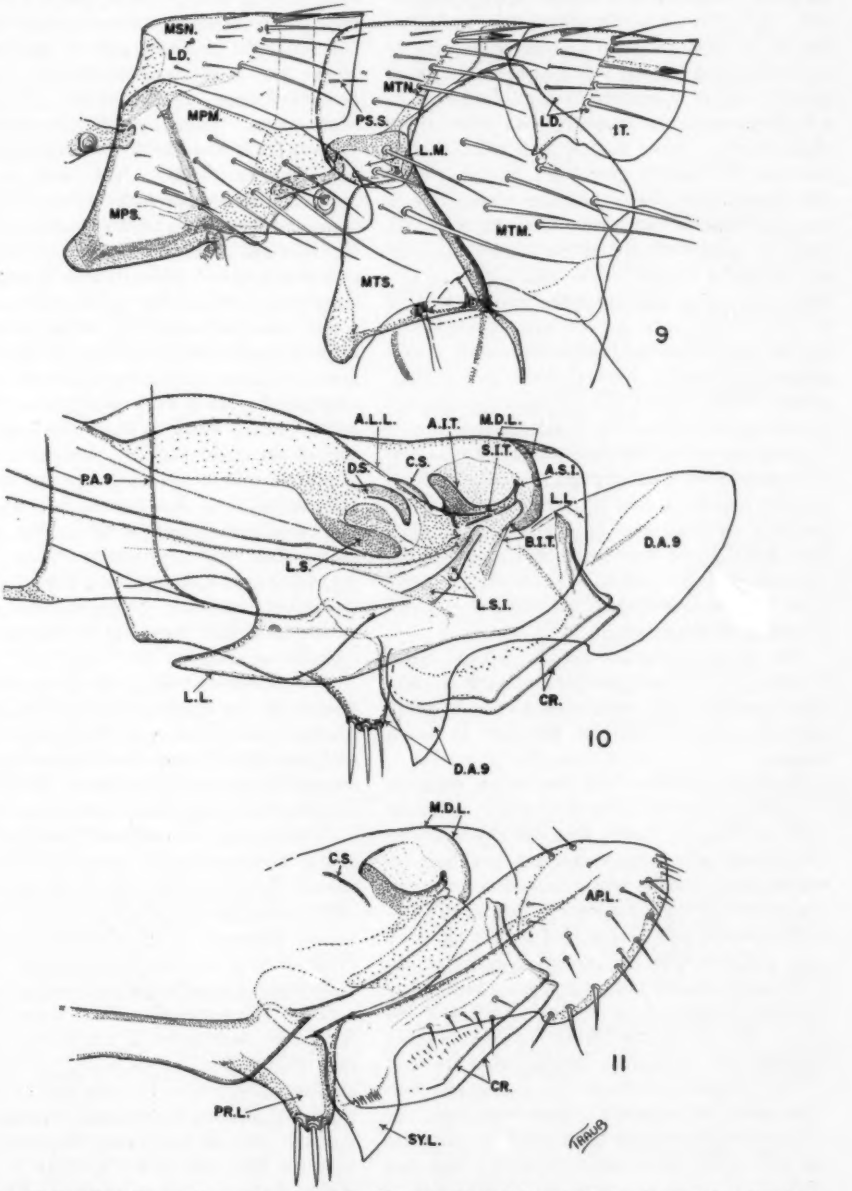
Abdomen.—First tergum (*1T.*) with two rows of bristles and one apical spinelet per side. Basal sternum lacking lateral or mesal bristles; with one ventromarginal bristle in male, two in female. Terga II to IV with apical spinelets as follows: 2-2-1 per side. First row of bristles on typical terga with about five to seven bristles per side, terminating well above spiracle; second row of bristles extending to or slightly below level of spiracle. Typical sterna in male with three or four subventral bristles per side, preceded by two to four smaller ones; in female with a row of five to seven bristles preceded by four to six smaller bristles in one or two ventromarginal rows. Antesensiliary (antepygidial) bristles as follows: one long bristle in male; in female either three or four long bristles, of which upper two are slightly the longer.

Modified abdominal segments, male (Fig. 5).—Eighth tergum (*8T.* and Fig. 3) very large and enclosing most of genitalia, as is typical for subfamily; with a dorsomarginal row of bristles of increasing size extending to just short of midpoint; remainder of dorsal region lacking bristles; with a closely appressed group of five submarginal bristles near ventrocaudal angle; and with three long lateral or subdorsal bristles. Eighth sternum (*8S.*) dorso-apically produced into a long semimembranous filamentous flap or projection as long or longer than rest of segment; apically minutely frayed; tufted; with a long, conspicuous ventromarginal bristle at origin of above long narrow flap; sclerotized portion of segment, as measured from base to insertion of long bristle, more than five times as long as broad at midpoint—at base the ratio is three to one. With a frayed or spiculose semimembranous intersegmental process (*I.M.*) between eighth and ninth sterna. Immovable process of clasper (*P.* and Fig. 8) a long, thumb-like projection, with three small apical bristles. Acetabular bristle (*AC.B.*) inserted on a subacute convexity at a level slightly below midpoint of caudal margin of *P.* Movable finger or digitoid (*F.*) very large, essentially roughly cleaver-shaped; anterior and dorsal margins fairly straight; posterior margin angled and somewhat hooked, producing apparent caudal and ventral margins—of these, caudal margin mildly undulate and running slightly obliquely to anterior margin; ventral margin twice as long as dorsal margin, sinuate, with anterior half convex, posterior half concave. *F.* somewhat more than half as broad at midpoint as long at maximum point; with two heavy stout bristles at dorsocaudal angle; with a subspiniform at hook of ventrocaudal angle; immediately above this another marginal spiniform; a third such subspiniform inserted at ventral third of caudal margin. Manubrium (*MB.*) broad but apically acuminate. Ninth sternum with proximal arm (*P.A.9*) narrow, subapically upturned and then straightening so that apical portion is somewhat beak-shaped. Distal arm of ninth sternum (fig. 11) as long as proximal arm; its apical two-thirds modified along the ventral margin as follows: a conspicuous, ovate proximal lobe (*PR.L.*) which bears three short stout bayonet-shaped marginal bristles; immediately above and laterad to proximal lobe a peculiar broad subacute, downward-directed secondary lobe (*SY.L.*) which is devoid of bristles; distally expanded to form a long ovate apical lobe (*AP.L.*) which bears about 12 to 15 marginal bristles. In addition, distal arm with scattered thin bristles on apical lobe and two such dorsomarginal bristles; with about six ventromarginal thin bristles between secondary lobe and apical lobe.

Aedeagal apodeme (*AE.A.*) relatively narrow, about eight times as long as broad, as measured from the middle of the constricted neck (*N.*) to the short acuminate apical appendage (*AP.A.*); with a long, well-developed proximal spur (*P.S.*). Aedeagal endchamber (Fig. 10) characterized by the well-developed lateral lobes (*L.L.*) which are produced into conspicuous acuminate cephalad-directed flaps anterior to proximal lobe (*PR.L.*) of *D.A.9*. Median dorsal lobe (*M.D.L.*) slightly sinuate, heavily sclerotized where it turns straight ventrad at apex of inner tube. Crochets (*CR.*) quite long, about twice as long as broad but weakly sclerotized so that its outlines are difficult to see; caudal margin fairly well sclerotized, concave; ventral margin straight for about two-thirds its length, then curving upwards towards point of insertion; the peg-like sclerotization, characteristic of the crochet of ceratophyllid fleas, undeveloped, inconspicuous. Sclerotized inner tube (*S.I.T.*) short, bearing a prominent dorsoproximal thumb-like armature (*A.I.T.*) and with its apex (*A.S.I.*) produced upwards as a narrow spur. With sclerotized narrow band of inner tube (*B.I.T.*) extending distad of *S.I.T.* Lateral sclerotization of inner tube (*L.S.I.*) rather prominent. Crescent sclerite (*C.S.*) overlying apodemal strut, which is of the usual type. Sensilium (*SN.*) very flat, with about 15 pits

per side. Dorsal lobe of proctiger (*D.A.L.*) an isosceles triangle lying on its side; with a dorsal row of bristles; ventral lobe of proctiger longer and narrower, with an apical tuft of bristles.

Modified abdominal segments, female (Fig. 6).—Seventh sternum (*7S.*) with a shallow broad sinus on caudal margin. Lobes above sinus evenly rounded; with an irregular oblique row of about



FIGS. 9–11.—*Hollandipsylla neali*, n. gen., n. sp.: 9, Thorax; 10, end chamber of aedeagus; 11, distal arm of ninth sternum, male

eight fairly long bristles which merges with a ventromarginal row of approximately eight; with a row of three or four smaller bristles preceding the oblique row; in addition, with about five or six small ventromarginal bristles. Eighth tergum (*8T.*) with four or five bristles below sensilium five or six caudomarginal bristles below ventral anal lobe (*V.A.L.*) and a lateral and subventral group of about 13 bristles, two or three of which are submarginal; in addition, with three short mesal bristles below ventral anal lobe. Eighth sternum (*8S.*) lightly sclerotized, devoid of bristles. Dorsal anal lobe of proctiger with a row of marginal bristles and about 10 to 12 scattered lateral or lateromedian bristles; in addition, with five marginal bristles below anal stylet (*A.S.*). Anal stylet (Fig. 2) about three times as long as broad at base; with a very long apical bristle and a long ventromarginal bristle; with a tiny dorso-apical bristle. Ventral anal lobe (*V.A.L.*) almost evenly curved, not conspicuously angled. Spermatheca (*SP.* and Fig. 7) somewhat deformed in specimen extant but the head more than twice as long as broad; dorsal margin somewhat convex, ventral margin almost straight, with tail apparently recurved over head and much shorter than head. Bursa copulatrix (*B.C.*) subglobose, its duct slightly curved, short; with a narrow blind duct narrower than but more than twice as long as *ductus bursae*.

This species is named for Dr. William Neal, director of the Medical Services in North Borneo, who rendered great assistance to the Medical Research Units working in the field in North Borneo.

Comment.—Eyeless fleas are either parasites of typically subterranean or wholly nocturnal hosts, or else are forms that are characteristic inhabitants of rodent nests and modified accordingly (*1*, *2*). The nest inhabitants are rarely found on the hosts themselves and apparently feed while the mammal or bird is sleeping. Such species of fleas typically possess elongate mouthparts and reduced chaetotaxy, including reduction in the size and/or number of spines of the genal and other combs (*3*). In the description of *Ceratophyllus arcuegens*, collected from the nest of cliff swallows, Holland (*4*) points out that this species is evidently rather sedentary, "as indicated by the rather large and deep abdomen as well as by some reduction of the legs and thorax." *C. arcuegens* lacks the pleural arch, a socket arrangement or "head" capping the pleural ridge. Certain other nest-fleas also lack a pleural arch, e.g., *Anomiopsyllus* Baker, 1904, *Megarthroglossus* Jordan and Rothschild, 1915, *Conorhinopsylla* Stewart, 1930, *Stenistomera* Rothschild, 1915, and *Wenzella* Traub, 1953. The pleural arch is also absent in some squirrel fleas, i.e., *Hollandipsylla* gen. nov., and, as pointed out by Traub (*5*), *Syngenopsyllus* Traub, 1950, *Tarsopsylla* Wagner, 1927, *Libyastus* Jordan, 1936, *Myoxopsylla* Wagner, 1927, *Brachyctenonotus* Wagner, 1929 and the fleas of the genus *Opisodasys* Jordan, 1933, which parasitize flying squirrels (*O. pseudarctomys* (Baker, 1904) and *O. vesperalis* (Jordan, 1929)). These squirrel fleas are relatively rare in collections even though their true hosts are fairly frequently encountered. Some (i.e., *Tarsopsylla*) have been found to be rather abundant in the nest of the host, but too little is known of the habits of these fleas to indicate whether such occurrence is the rule. The long labial palpi (i.e., *Syngenopsyllus*), the elongate legs (i.e., *Tarsopsylla*) and reduction in the size of the spines of the pronotal comb (i.e., *Brachyctenonotus*) in this group of fleas indicate that the squirrel fleas lacking the pleural arch may also be nest-inhabiting species. A pleural ridge of this type may therefore be an important structural modification of nest-fleas, and may be associated with the corresponding sedentary habits, as Holland suggests in the case of *Ceratophyllus arcuegens*.

Our current knowledge of the habits of *Hollandipsylla* are insufficient for us to determine whether the reduction of the eye is correlated with nest-inhabitation or with the nocturnal or crepuscular nature of the host, a flying squirrel. It is interesting, however, that reduced or vestigial eyes occur in unrelated fleas which parasitize subterranean or nocturnal hosts. Thus *Fozella* Wagner, 1929, and *Dactylopsylla* Jordan, 1929 (Ceratophyllidae), are parasites of American pocket gophers. *Pulex sinoculus* Traub, 1950 (Pulicidae), an eyeless species closely related to *P. irritans*, was collected on Guatemalan pocket gophers. The eyeless flea of the Cape dune mole, *Bathyergus maritimus*, is *Cryptoctenopsyllus* ingens (Rothschild, 1900) which is essentially a combless *Dinopsyllus* (Dinopsyllinae, Hystrichopsyllidae). Among the primarily nocturnal or crepuscular animals which carry fleas with reduced eyes are bats, parasitized by fleas in a distinct family, Ischnopsyllidae, and shrews (i.e., *Blarina*, *Sorex*) which are typically parasitized in North

America by *Doratopsylla* Jordan and Rothschild, 1912, and *Corrodopsylla* Wagner, 1929 (Ctenophthalminae, Hystrichopsyllidae). It should be pointed out that the above correlation is by no means perfect. In fact, the converse is apparently also significantly true. Certain nocturnal mammals have adapted themselves to their dim environment by developing enlarged eyes. The flying squirrels, the slow lorises (*Nycticebus*), and the tarsier are in this category. Certain fleas have apparently paralleled this development. Thus, some *Xenopsylla* occurring on nocturnal rodents in the desert have unusually large eyes. Other *Xenopsylla*, associated with similar hosts, have reduced eyes (e.g., *Xenopsylla crinita* Jordan and Rothschild, 1922), while the genus *Rooseveltiella* C. Fox, 1914, was established for a species occurring on the Cape mole rat, *Georychus*, or a similar burrowing mole-like animal, is actually an eyeless *Xenopsylla*.

Summary.—Hollandipsylla neali, a new genus and species of flea from a North Borneo flying squirrel, is described and illustrated in detail. It is unique among squirrel fleas of the subfamily Ceratophyllinae in being eyeless and in possessing only three pairs of lateral plantar bristles on the last segment of the tarsi, two proximal pairs being displaced mesad. Included is a discussion of species of fleas which are characteristic inhabitants of the nests of the hosts. It is pointed out that such fleas usually have elongate labial palpi and legs and are further characterized by a reduction of the eyes and in chaetotaxy and in the development of the thorax. Loss of the pleural arch of the thorax is common. It is pointed out that fleas which parasitize subterranean or nocturnal hosts usually have reduced or vestigial eyes, regardless of the true affinities of the flea species involved.

LIST OF ABBREVIATIONS

A.B.	Antesensiliary bristle.
AC.B.	Acetabular bristle.
AE.A.	Aedeagal apodeme.
AP.A.	Apical appendage of aedeagal apodeme.
AP.L.	Apical lobe of ninth sternum.
A.L.L.	Accessory lateral lobe.
AP.R.9	Apodemal rod of ninth sternum.
A.I.T.	Armature of inner tube.
A.S.	Anal stylet.
A.S.I.	Apex of sclerotized inner tube.
B.C.	Bursa copulatrix.
B.I.T.	Sclerotized band of inner tube.
CR.	Crochet.
C.S.	Crescent sclerite.
D.A.L.	Dorsal anal lobe of proctiger.
D.A.9	Distal arm of ninth sternum.
F.	Movable finger or digitoid of clasper.
I.M.	Intersegmental membrane.
L.L.	Lateral lobe of aedeagus.
L.M.	Lateral metanotal area.
L.S.I.	Lateral sclerotization of inner tube.
MB.	Manubrium.
M.D.L.	Median dorsal lobe of aedeagus.
MPM.	Mesepimere.
MPS.	Mesepisternum
MSN.	Mesonotum.
MTM.	Metepimere.
MTN.	Metanotum.
MTS.	Metepisternum.
N.	Neck or constriction of aedeagus.
P.	Immovable process of clasper.
P.A.9	Proximal arm of male ninth sternum.
P.R.	Penis rod.
PR.L.	Proximal lobe of distal arm of ninth sternum.
P.S.	Proximal spur of aedeagus.
PS.S.	Pseudosetae.
S.I.T.	Sclerotized inner tube of aedeagus.
SN.	Sensilium.
SP.	Spermatheca.
S.S.	Subpygidial sclerite.
SY.L.	Secondary proximal lobe of D.A.9.
7S.	Seventh sternum.
8S.	Eighth sternum.
7SPR.	Seventh spiracle.
8SPR.	Eighth spiracle.
1T.	First tergum.
7T.	Seventh tergum.
8T.	Eighth tergum.
V.A.L.	Ventral anal lobe.
VC.1	First vinculum, or link plate.
X.G.	So-called X-gland of Wagner.

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ENTOMOLOGY.—*A new species of* Culex *from the Marquesas Islands and the larva of* Culex atriceps *Edwards* (Diptera: Culicidae). ALAN STONE, U. S. Bureau of Entomology and Plant Quarantine, and LEON ROSEN, National Microbiological Institute.

In the course of mosquito surveys conducted in connection with filariasis studies on the six inhabited Marquesas Islands, the junior author found an apparently undescribed indigenous species of *Culex*, which is herein described. Because of similarity of this species to *Culex atriceps* Edwards, which is known only from the Society Islands, a description of the heretofore undescribed larva of the latter species is also given. The drawings are by Sally Kaicher.

Culex marquesensis, n. sp.
Figs. 1, A–C; 2, A–B

Male.—Length of body 3.5 mm. Vertex with curved decumbent yellowish-white scales centrally, these broader and more abundant on sides; centrally with numerous erect, forked, dark-brown scales. Palpus dark brown, the last two segments and apical part of the third with long unmodified hairs. Proboscis extending to middle of fourth palpal segment, entirely dark brown except for the yellowish labellae. Torus yellow; antenna not as long as proboscis. Scales of anterior pronotal lobe, posterior pronotum, scutum, and scutellum pale yellowish to brown; integument of scutum brown with a pair of straight central and a pair of curved lateral stripes of paler color in the usual pattern. Postscutellum pale. Thoracic setae brown. Pleuron greenish yellow, sometimes faintly mottled with darker; a few scattered flat pale scales on pleuron. One or two lower mesepimeral setae. Scales of wing dark; knob of halter dark, with dark scales. Legs entirely dark scaled except for paler posterior surfaces of the femora. Dorsum of abdomen dark scaled, with basal bands of pale scales on tergites 2–6, that on 2 slightly separated from base by an unscaled area; venter likewise banded, the pale basal bands often broader. Terminalia: Basistyle nearly three times as long as broad, without scales, but with long hairs dorsally and laterally; subapical lobe slightly beyond middle, divided into two parts, the ventral portion a short lobe bearing three stout, parallel filaments, the two distal ones hooked at tips, the third shorter and straight; inner (more dorsal) portion a short cone with a single straight, tapering filament; between these a striated leaf and distad of this leaf a single slender hair on a tuberele. Dististyle broad and flattened, the end abruptly tapering with a short distal spine. Dorsal arms of mesosome straight, untoothed, slightly divergent; ventral arms a mass of curved teeth; tenth sternites distally with a mass of tapering spines; lateral arms broad, blunt, curved ventrally. Ninth tergite forming a broad V, weakly haired.

Female.—Coloration essentially as in male, but scales generally slightly darker and pale areas of posterior surfaces of femora usually restricted to basal halves on mid and hind femora; pale abdominal bands narrow, the hind margins straight. Palpus about one-sixth length of proboscis.

Larva.[1] Head: Length three-fourths of width; color yellow, usually with a dark band across frontal hair area. Antenna smooth, short, its length slightly more than one-third distance between bases of antennae, cylindrical, about six times as long as thick, not tapering; shaft hair usually triple, at middle of antenna and reaching about to apex. Clypeal spine moderately stout, curved; outer clypeal hair small, no postclypeal hair; inner frontal hairs single, widely separated, placed behind level of antennal bases; midfrontal hairs single, long, directly in front of inner frontals and in front of level of antennal bases; outer frontal hairs usually triple, directly above or slightly anterior to base of antenna. Mental plate subtriangular, the sides convex, with about eight teeth on each side.

Thorax: Integument smooth; prothoracic hair 0 very small, double; 1–3 on one tubercle, all single, 1 longest, 3 shortest; 4 single, halfway between shoulder hairs and hair 5; 5–7 close together, 5 and 6 single, 7 double; hair 8 small, single; hairs 9, 10, and 12 long, simple; 11 very small, double; 14 small, single.

Abdomen: Segments III–VI each with only one large lateral hair, 3- to 5-branched. Segment

[1] The nomenclature of the larval chaetotaxy used here is that of Belkin (1950).

VIII with pentad hair 1 3- to 9-branched; 2 single and very close to 1; 3 7- to 10-branched; 4 single; 5 2- to 4-branched. Comb scales 21 to 26 in a triangular patch, each scale broadened apically with an even fringe of hairs. Air tube three times as long as broad, only slightly tapering at distal third; acus well developed. Siphonal hairs 4 or 5 in each of two straight, widely separated rows, each hair about as long as width of siphon, multiple, the first at basal fifth to third, the last at about apical third. Pecten of 6 to 11 teeth, each with 5 slender, deep, serrations. Anal segment ringed by the saddle, the ventral half abruptly narrowed to about one-half the length of the dorsal half. Only very minute spines dorsally at apex. Lateral hair of saddle very small, 4- to 5-branched. Inner dorsal hair with about 5 long branches, outer dorsal hair long, single. Anal gills four, rather stout, the dorsal pair about twice as long as dorsal length of saddle, the ventral pair about three-fourths as long as dorsal pair. Ventral brush of about 12 tufts.

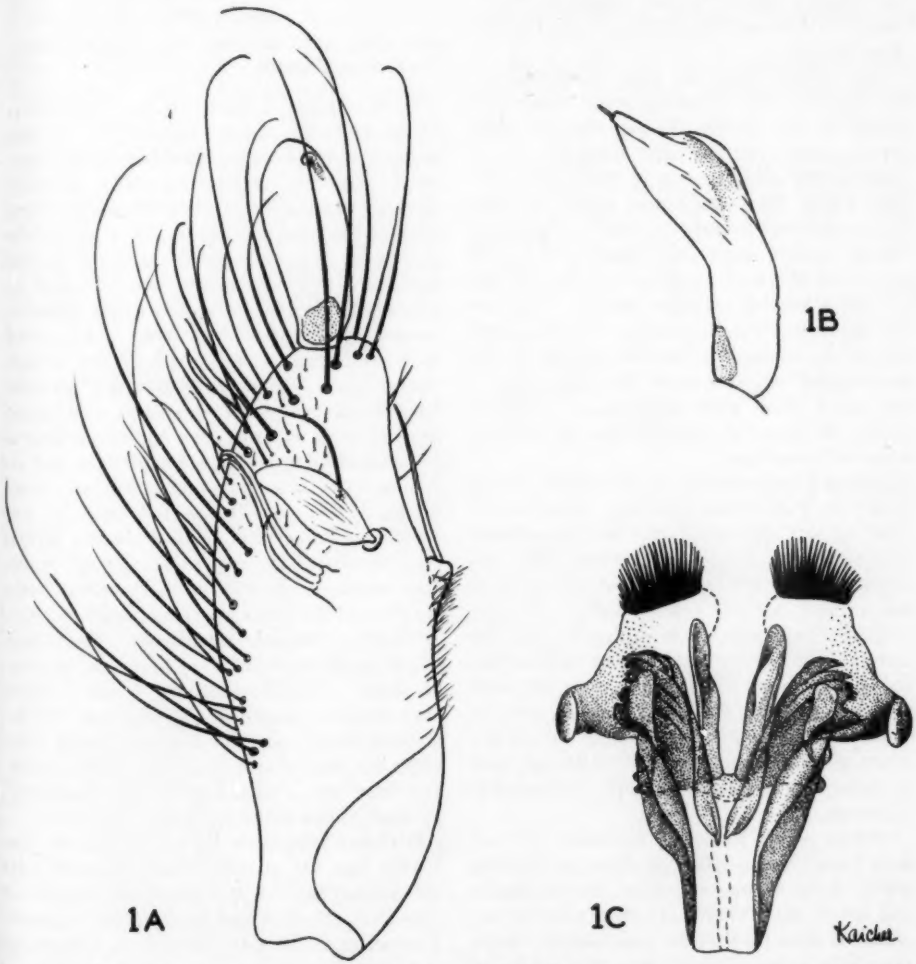

FIG. 1.—*Culex marquesensis*, n. sp.: A, Basistyle and dististyle of male, ventral view; B, dististyle, lateral view; C, mesosome and tenth sternites, dorsal view.

Holotype.—Male, ex barrel top, Atuona Bay, Hivaoa, Marquesas Islands, June 12, 1952 (Leon Rosen) with genitalia and larval and pupal exuviae on slide. Paratypes, same data, 182 males and females. Holotype and paratypes (U. S. National Museum no. 61839); paratypes, British Museum, Paris Museum, California Academy of Sciences, Bishop Museum, School of Hygiene and Public Health of the Johns Hopkins University, and South Pacific Commission, Noumea, New Caledonia. Additional specimens were collected on Nukuhiva (Taiohae and Taipivai Bays), Uapou (Hakamaii Bay), Uahuka (Vaipae and Hokatu Bays), and Tahuata (Hapatoni Bay).

This species shows no close relationship to any described Pacific species other than *Culex atriceps* of the Society Islands. Both of these species appear to fall into Edwards' *decens* series, of the *pipiens* group of the typical subgenus *Culex*. This is an African group, in which the proboscis and tarsi are all dark, the abdominal tergites usually have only basal lateral pale spots, and the male palpi are usually without any white line on the lower surface of the last two segments. The terminalia of *marquesensis* are rather similar to those of several of the *decens* series. Edwards noted that the larvae of this series show great variation, a condition further developed if both *atriceps* and *marquesensis* are included.

Although *marquesensis* is not closely related to *C. quinquefasciatus*, the only other known *Culex* in the Marquesas, it could be confused with it by superficial examination. The best external characters to distinguish the adult of *marquesensis* are the yellow labellae, strongly contrasted with the dark proboscis, and the uniformly dark brown scaling of the mesoscutum. In *quinquefasciatus* the labellae may be somewhat paler but never as strongly contrasted, and the mesonotal scales are distinctly tinged with yellow or orange. The single inner and midfrontal hairs of the larva of *marquesensis* readily distinguishes this stage.

Biology.—The larvae of *marquesensis* have been found in the following types of breeding places: water drums, rock holes, coconut husks, and barrel tops. They have been found in association with both *Aedes polynesiensis* Marks and *Culex quinquefasciatus* Say. The adults of *marquesensis* were not found in nature.

Two other species of mosquitoes, *A. polynesiensis* (formerly known as *A. pseudoscutellaris*) and *C. quinquefasciatus*, have previously been reported from several of the Marquesas Islands. (Marks 1951) New distribution records from the recent surveys are as follows: *A. polynesiensis*—Uapou; *C. quinquefasciatus*—Uapou, Uahuka, and Nukuhiva. Both *A. polynesiensis* and *C. quinquefasciatus* have now been found on all six inhabited islands of the group and *C. marquesensis* has been found on five of these six islands.

Culex atriceps Edwards
Fig. 3, A–B

Bull. Ent. Res. **17**: 105, 1926. Type locality, Papeari, Tahiti.

Larva.—Head: Length about three-fourths width; yellowish, weakly darkened on the disk posteriorly and a darker spot behind but separated from eye. Antenna sparsely spiculate, short, its length about one-third distance between bases of antennae, cylindrical, about eight times as long as diameter, slightly narrowed beyond shaft hair, which is slightly beyond middle of antenna, multiple. Clypeal spines slender, curved; outer clypeal hair small; post clypeal hairs very small, double, about on line of midfrontal hairs; frontal hairs distinctly plumose; inner frontal hair 5- to 8-branched, well behind level of bases of antennae; midfrontal hair 4- to 6-branched, near inner frontal hair and on line between inner and outer frontals; outer frontal hair 7- to 11-branched near to, but slightly posterior to antennal bases. Mental plate subtriangular, with a very strong, prominent median tooth and 10 to 11 lateral teeth, the 7th and 8th from apex being largest.

Thorax: Integument smooth. Prothoracic hair 0 small, multiple; 1 to 3 on one tubercle, all single, subequal; 4 double; 5 and 6 rather close together, single; 7 more distant, double; 8 rather small, single; prothoracic pleural group with one long simple hair, two much shorter and finer, and a much smaller one 4-branched; 14 small, single or double.

Abdomen: Segments III to VI with one long lateral hair, 2- or 3-branched. Segment VIII with pentad hair 1 3- to 5-branched, 2 single and close to 1, 3 7- to 9-branched, 4 single, 5 usually 2-branched. Comb scales 30 to 40 in a triangular patch, each scale broadened apically with an even fringe of hairs. Air tube 3 to 3.5 times as

long as basal width, rather evenly tapered to apex; acus well developed. About six pairs of siphonal tufts rather irregularly arranged on the median three-fifths of the siphon ventrally, none of the hairs displaced to the side; tufts mostly longer than width of siphon at point of insertion, except for the small apical pair. Pecten of 10 to 20 teeth extending to or somewhat beyond middle of siphon; each tooth usually with 2, 3, or rarely 4, serrations. Anal segment ringed by the saddle, the ventral length about two-thirds dorsal length; lateral hair small, single, or rarely, double. A patch of rather large spines on the saddle at apex to each side of dorsal hairs. Inner dorsal hair 11- to 14-branched; outer dorsal hair long, usually single, rarely double. Anal gills 4, rather stout, subequal, from about length of anal segment to more than twice length of saddle. Ventral brush of 11 or 12 tufts.

This description is drawn from specimens collected by the junior author from a tree hole at Paoa, Tahiti, January 2, 1952, and from the exuviae of reared specimens from a coconut husk at Vairao, Tahiti, May 8, 1952.

The forward position of the multiple head hairs and the length of the pecten are characteristic of the larva of this species. A closely related larva was collected from *Pandanus* axils on Tahiti but no adults were reared. It does not seem advisable to describe this species until adults can be associated.

Biology.—The larvae of *C. atriceps* have been found on the islands of Tahiti and Moorea

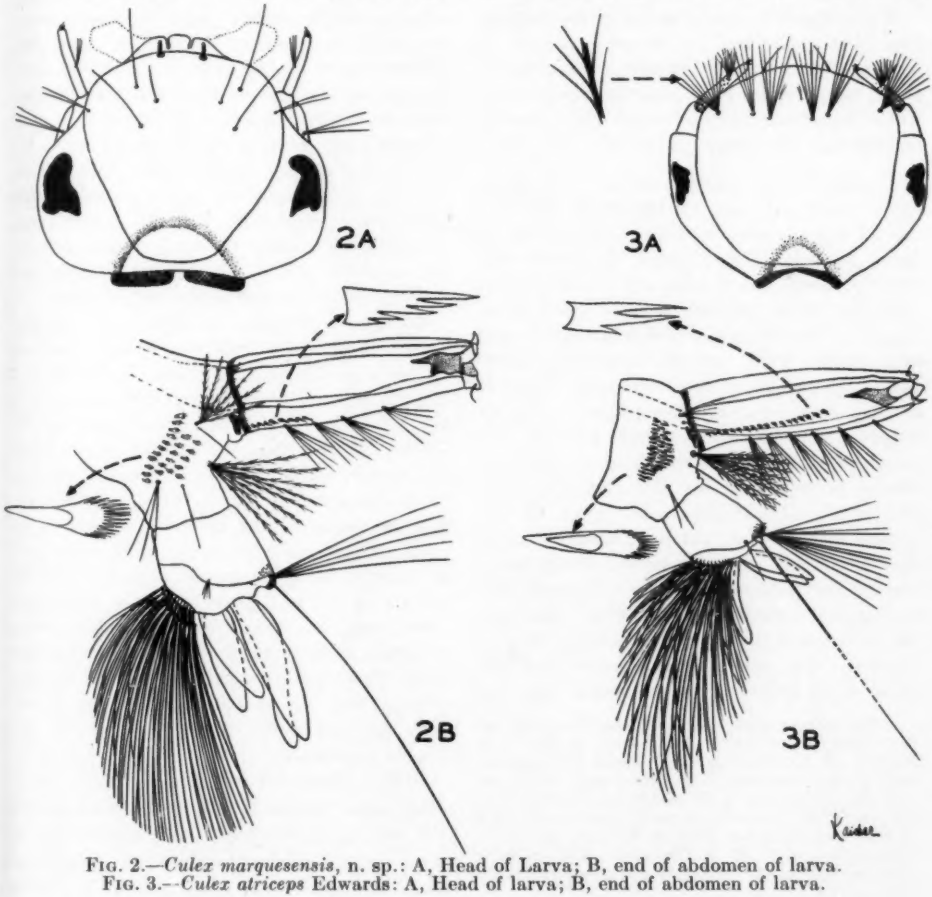

FIG. 2.—*Culex marquesensis*, n. sp.: A, Head of Larva; B, end of abdomen of larva.
FIG. 3.—*Culex atriceps* Edwards: A, Head of larva; B, end of abdomen of larva.

(Society Islands) in the following types of breeding places: tree holes, coconut husks, and various types of artificial containers. The larvae are frequently found in association with those of *A. polynesiensis*. The adults have been observed to attack man at night, but rarely in considerable numbers. They are sometimes seen resting in houses but are more commonly found in natural resting places such as tree buttresses.

The junior author has shown that occasional specimens of the species are capable of allowing complete development of Polynesian strains of *Wuchereria bancrofti*. *C. atriceps* would not seem to be an important vector of this parasite in nature because of its inefficiency as a host and the rarity with which it attacks man.

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ENTOMOLOGY.—Laelaps oryzomydis, *n. sp., with a key to some American species of* Laelaps (Acarina: Laelaptidae). H. D. PRATT and JOHN E. LANE,[1] U. S. Public Health Service, Atlanta, Ga.

A new species of mite in the genus *Laelaps* has been collected in several States in southeastern United States. The species name **oryzomydis** here assigned to it refers to the fact that the type series was collected on rice rats (*Oryzomys palustris*).

Female (Fig. 1).—Length, exclusive of gnathosoma, about 0.6 mm, width about 0.4 mm. Chelicera with basal segment about as long as apical segment without chelae, fixed chela with two fine teeth and a seta, and movable chela with two teeth opposite seta of fixed chela. Jugularia absent but a differentiated jugular area present which extends across the sternal plate. Sternal plate widest between coxae II and III, posterior margin moderately, irregularly concave, anterolateral corners pointed, the usual six setae present with slightly expanded sternal pores behind the four anterior setae. Endopodal plates distinct and small. Genito-ventral plate with anterior margin faintly striate, strongly expanded behind fourth coxae, bearing four pairs of setae which are longer than the interval between adjacent setae. Anal plate similar in shape to that in *Haemolaelaps glasgowi* (Ewing), the anterolateral corners rounded, anus about three-fourths its length from the anterior margin of anal plate, the paired setae tangential to posterior margin of anus and distinctly more slender than the posterior seta. Coxa I has the internal spine distinctly stouter than the external spine; coxa II has a slender anterior and stout posterior spine; coxa III has a long slender anterior and stout, short, posterior spine; coxa IV has a single minute seta near the coxaltrochanteral articulation. Dorsal shield nearly covering dorsal surface, the majority of the seta almost as long and strong as those on the genito-ventral plate.

Laelaps oryzomydis is closest to *Laelaps nuttalli* Hirst, which is collected in large numbers by workers of the U. S. Public Health Service Typhus Control Program. It differs from this last species in having the internal spine on the forecoxa stouter than the external spine, while the reverse is true in *nuttalli*. The anal plate is more triangular in *nutalli* than in *oryzomydis*. The two setae on the posterior margin of the genito-ventral plate are more widely separated in *nuttalli*, being tangential with the anterior corners of the anal plate, while in *oryzomydis* these setae are placed closer together, being definitely median to the corners of the anal plate. There are expanded pores behind the two anterior and two middle setae on the sternal plate in *oryzomydis*. These are reduced and slit-like in *nuttalli*.

Male.—About 0.5 mm long. Very similar to other male *Laelaps*. It falls in the group having the sternal, genitoventral, and anal plates all fused into one arrowhead-shaped holoventral plate and the dorsal plate with long, slender

[1] The writers wish to acknowledge the constructive criticism of Dr. E. W. Baker, of the U. S. Bureau of Entomology and Plant Quarantine, during the preparation of this paper. They are also grateful to Drs. S. W. Simmons, H. P. Nicholson, and C. M. Tarzwell, of the Technology Branch of the Communicable Disease Center, and B. A. Barrington and C. B. Worth, who made available these collections of ectoparasites upon which the new species is based.

setae. Chelicera with chelae long and slender, smooth, apparently twice as long as the segment which bears them. The second and fourth tarsi with slender setae, peritreme extending to middle of coxa II.

Holotype.—Female, Jasper County, S. C., December 8, 1948, H. P. Nicholson. Collected from rice rat (*Oryzomys palustris palustris* (Harlan)). U. S. National Museum no. 2073.

Allotype.—Male, same data as above, in the U. S. National Museum.

Paratypes.—Tampa, Fla., March 1949, C. B. Worth, host *Oryzomys palustris natator* Chapman, 8 paratype females; Gainesville, Fla., November 17, 1946, B. A. Barrington, host *Oryzomys palustris natator* Chapman, 8 paratype females; Jasper County, S. C., from March 5 to December 10, 1948, all on *Oryzomys palustris palustris* (Harlan), 50 paratype females mounted on slides.

Holotype, allotype, and paratypes in the U. S. National Museum collection. Paratypes in the U. S. Public Health Service, Communicable Disease Center collection, Atlanta, Ga.; Rocky Mountain Laboratory at Hamilton, Mont.; and Western Communicable Disease Center Laboratory, San Francisco, Calif.; Texas State Department of Health collection, Austin, Tex.; and the private collection of Dr. R. W. Strandtmann, Lubbock, Tex.

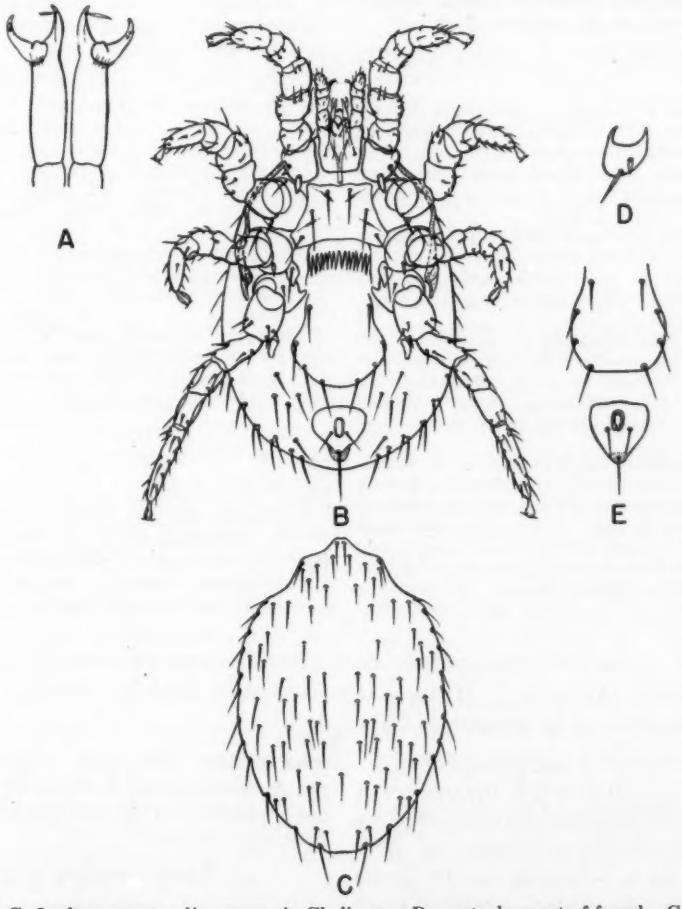

FIG. 1.—A–C, *Laelaps oryzomydis*, n. sp.: A, Chelicerae; B, ventral aspect of female; C, dorsal plate of female. D, E, *Laelaps nuttalli* Hirst: D, Forecoxa of female; E, genitoventral and anal plate of female.

This species probably breeds throughout the year on rice rats, various subspecies of *Oryzomys palustris*. The biggest collection, from Jasper County, S. C., game refuge, contained at least 46 *Laelaps oryzomydis*. The rice-rat louse (*Hoplopleura oryzomydis* Pratt and Lane) and the following mites were also found in collections from rice rats: *Gigantolaelaps cricetidarum* Morlan, *Haemolaelaps glasgowi* (Ewing), *Haemolaelaps megaventralis* Strandtmann, *Bdellonyssus* species near *bacoti*, *Androlaelaps* species, and often hundreds of mites of the family Listrophoridae on a single rice rat. The cotton-rat flea (*Polygenis gwyni* (C. Fox)) was also found in these same collections.

The following keys to male and female *Laelaps* are modified from those of Grant (1947):

A KEY TO SOME SPECIES OF MALE NORTH AMERICAN LAELAPS

1. Dorsal plate with long, hairlike setae; sternal, genitoventral, and anal plates all united into a single holoventral plate.....2
   Dorsal plate with short, spiniform setae; sternal and genitoventral plates united, but separate from anal plate.....5
2. Second tarsus with some short curved spiniform setae near tips (on microtine mice) *L. alaskensis* Grant
   Second tarsus without curved spiniform setae, all straight.....3
3. Peritreme tube extending to coxa II; second tarsus with slender setae only (on rice rats, genus *Oryzomys*).....*L. oryzomydis*, n.sp.
   Peritreme tube extending forward beyond coxa II; second tarsus with some stout setae.....4
4. Larger species at least 0.9 mm long (on domestic rats, genus *Raitus*)..*L. echidninus* Berlese
   Smaller species 0.5 to 0.8 mm long (on domestic rats, genus *Rattus*).....*L. nuttalli* Hirst
5. United sternal and genitoventral plate widely separated from the anal plate and with posterior border slightly concave (on microtine mice).....*L. kochi* Oudemans
   United sternal and genitoventral plate with posterior border proximal to the anal plate (on muskrats, genus *Ondatra*) *L. multispinosus* Banks

A KEY TO SOME SPECIES OF FEMALE NORTH AMERICAN LAELAPS

1. Anal plate contiguous with genitoventral plate and fitting into a strong concavity in genitoventral plate (on domestic rats in genus *Rattus*).....*L. echidninus* Berlese
   Anal plate separated from genitoventral plate, which is usually convex or straight on posterior margin, not strongly concave.....2
2. Dorsal setae long and slender.....3
   Dorsal setae small and short.....5
3. Internal spine on forecoxa distinctly stouter than external spine (on rice rats in genus *Oryzomys*).....*L. oryzomydis*, n.sp.
   Internal spine on forecoxa more slender than external spine.....4
4. Genitoventral plate widely separated from anal plate; anal plate with anterior margin rounded (on microtine mice) *L. alaskensis* Grant
   Genitoventral plate extending posteriorly almost to anal plate; anal plate with anterior margin truncate and definite angular anterolateral corners (on domestic rats in genus *Rattus*).....*L. nuttalli* Hirst
5. Anal plate subtriangular; posterior border of sternal plate deeply arched; coxal spines not greatly enlarged basally (on microtine mice).....*L. kochi* (Oudemans)
   Anal plate suboval; posterior border of sternal plate poorly defined, not greatly arched; coxal spines greatly enlarged basally (on muskrats of genus *Ondatra*) *L. multispinosus* Banks

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ZOOLOGY.—*Two new semiparasitic harpacticoid copepods from the coast of New Hampshire*. ARTHUR G. HUMES, Department of Biology, Boston University. (Communicated by Fenner A. Chace, Jr.)

Two new species of semiparasitic harpacticoid copepods were found in the summer of 1952 during routine classroom study of living invertebrates at the University of New Hampshire. One, belonging to the genus *Nitocra* Boeck (Ameiridae), inhabited small pits in the exumbrellar surface of a scyphozoan medusa. The other, a memebr of the genus *Mesamphiascus* Nicholls (Diosaccidae), occurred on the first maxillipeds of the American lobster.

Nitocra medusaea, n. sp.

Approximately 1,030 individuals of this copepod were discovered on the exumbrellar surface

of a living medusa of an unidentified species of *Aurelia*, about 3 inches in diameter, collected by Dr. Mary D. Rogick on July 17, 1952, off Fort Stark, in the harbor of Portsmouth, N. H. When undisturbed, the copepods remained in flask-shaped pits in the exumbrella, the largest pit being about 1–1.5 mm deep and 1 mm in diameter. There were more than thirty pits on this medusa, each with 10–30 or more copepods. Since the bodies of the copepods massed together in the pits were opaque or slightly cream-colored, the medusa appeared to the unaided eye as though there were sand grains embedded in the jelly. One might presume that the pits resulted from the presence of the copepods, but whether or not the copepods excavate the pits is not known. When examined under intense illumination or when disturbed with a needle, the copepods became active and crawled in and out of the pits and over the exumbrellar surface, clinging tenaciously to bits of debris and jelly fragments.

The type material consists of more than 1,000 individuals, representing both sexes. The holotype female (No. 95305), allotype (No. 95306), and paratypes (300 females and 100 males, No. 95307) have been deposited in the United States National Museum. Other paratypes are in the author's collection.

Female.—In life the body (Fig. 1) is transparent, without distinct color. The eye is bright red. The total length (measuring from the tip of the rostrum to the posterior end of the caudal rami), based on five specimens, is 0.79 mm (0.75–0.82 mm). The ratio of length of the head (plus rostrum) and the first five leg-bearing thoracic segments to the genital segment and abdomen (plus caudal rami) is 49:30. The genital segment has a slight indication of subdivision into two segments, especially visible on the dorsal side. The abdomen is 3-segmented. The actual and proportional lengths of the rostrum, body segments, and caudal rami are:

Rostrum	Head plus somite of leg 1	2	3	4	5	6	1	2	3	Caudal rami
27μ	177	79	70	71	66	109	68	54	50	23
3	22	10	9	9	8	14	9	7	6	3 = 100

The greatest body width is at the level of the first leg-bearing thoracic segment where it is 206μ. The length of the inner long seta on the caudal ramus is 419μ.

The rostrum (Fig. 2), curved slightly ventrally, narrows to a rounded point distally, and bears two small setae dorsally. The head and first four leg-bearing thoracic segments bear minute setae (Fig. 3) whose number and arrangement are difficult to discover because of the opacity of the body in preserved specimens. The fifth leg-bearing thoracic, genital, and abdominal segments are armed as indicated in Figs. 1, 3, and 4. The dorsal subdivision of the genital segment is marked by a medially interrupted transverse row of small setae as well as by the cuticular furrow. The anal operculum has a row of dentiform setae along the free edge. On either side of the operculum there is a row of spines which continues around on the ventral surface, becoming progressively smaller.

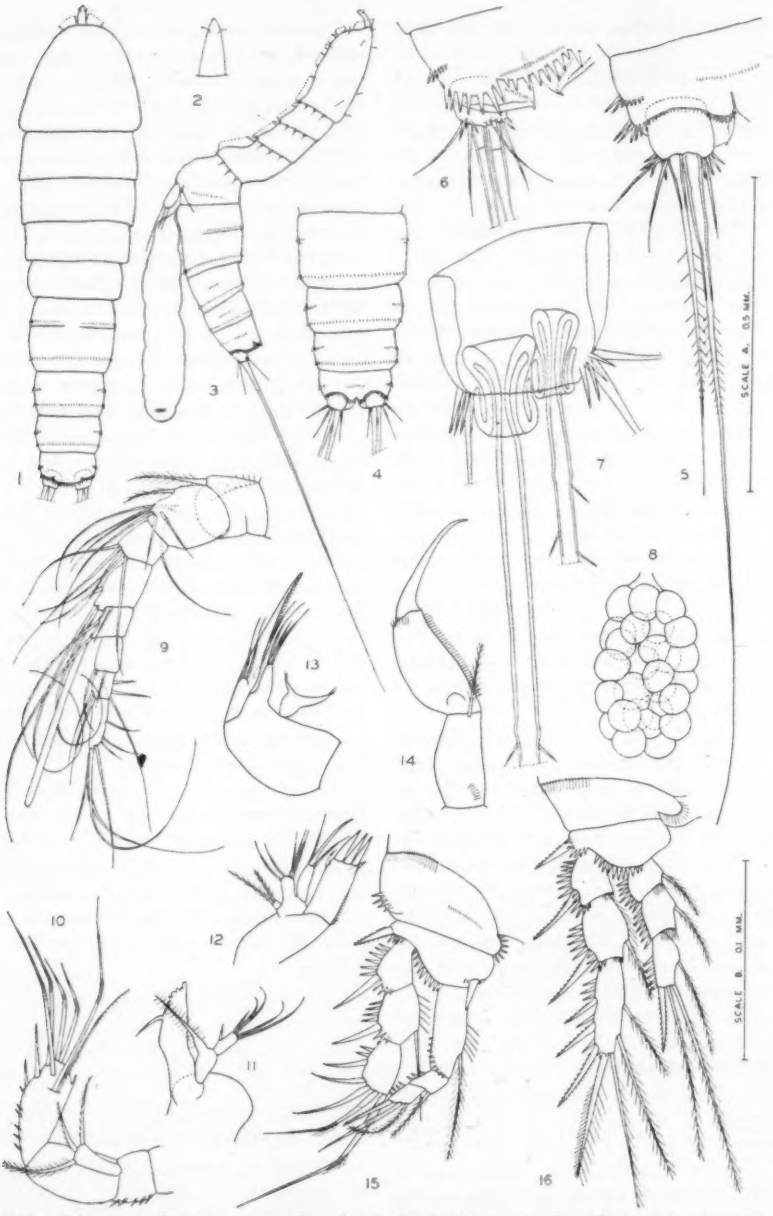
The caudal ramus (Figs. 5 and 6), slightly wider than long, bears distally two long setae of unequal length. These setae show a distinct "joint" near their bases of slightly different appearance in dorsal and ventral views. Four shorter setae are also associated with the caudal ramus, two on the outer distal corner, one on the inner distal corner. and one with a jointed base on the distal dorsal surface of the ramus. In a single individual the two long setae on the left caudal ramus were retracted by a double folding near the bases, as shown in Fig. 7, while the setae on the corresponding right caudal ramus were in the usual extended position.

The egg sac (Figs. 3 and 8), flattened dorsoventrally and measuring about 262 x 157μ, by 85μ in thickness, reaches well beyond the caudal rami. It contains 28–30 eggs arranged in two layers, each egg about 51μ in diameter.

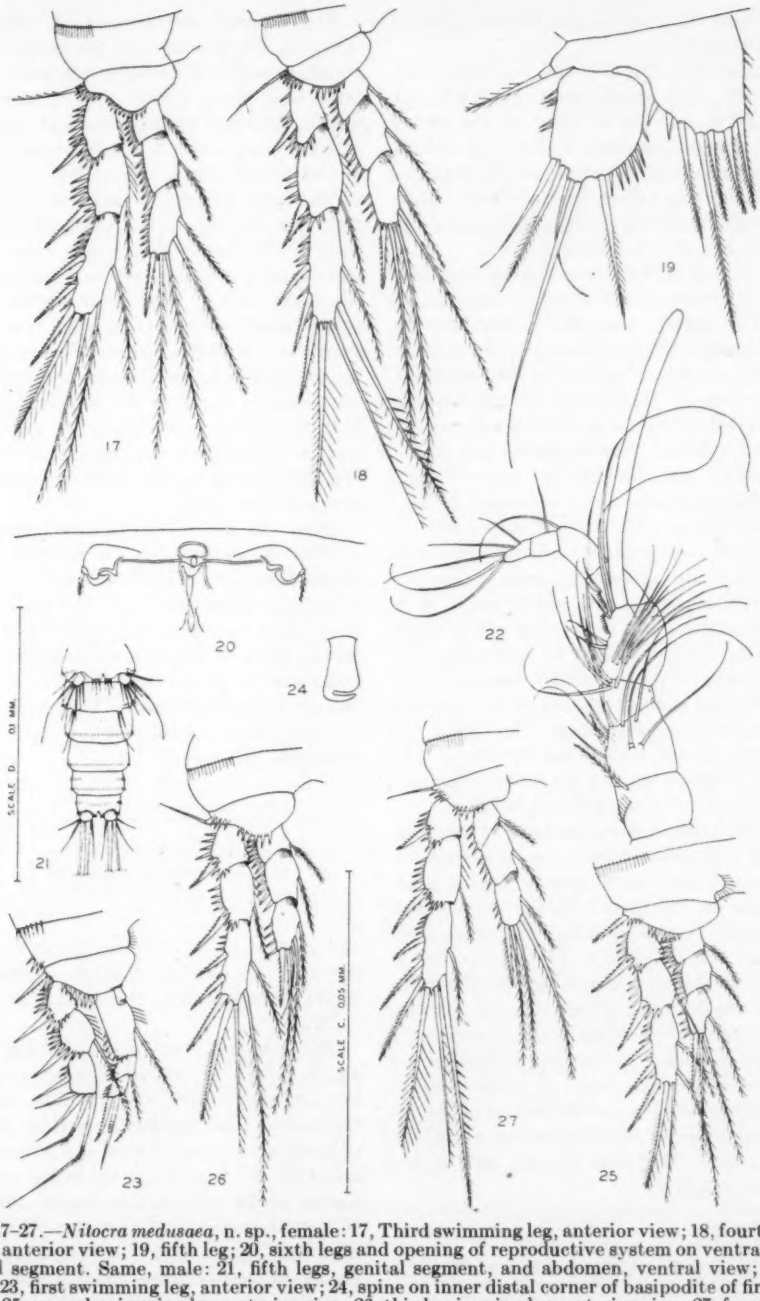
The first antenna (Fig. 9) has eight podomeres with the actual and proportional lengths as follows:

1	2	3	4	5	6	7	8
19μ	33	18	24	13	16	13	22
12	21	12	15	8	10	8	14 = 100

The entire antenna exclusive of setae is about 160μ long. On the fourth podomere there is an aesthetask or sensory filament 110μ in length, extending beyond the tip of the antenna. The first podomere bears a longitudinal row of small slender spines and a feathered seta at the inner distal corner. There is a small feathered seta about midway on the inner edge of the second podomere. The second antenna (Fig. 10) has a short basipodite, an endopodite of two podomeres,



FIGS. 1–16.—*Nitocra medusaea*, n. sp., female: 1, Body segments, dorsal view; 2, rostrum, dorsal view; 3, lateral view of body, thoracic and head appendages omitted; 4, genital segment and abdomen, ventral view; 5, caudal ramus, ventral view: 6, caudal ramus, dorsal view; 7, caudal ramus with retracted setae, ventral view; 8, egg sac; 9, first antenna; 10, second antenna; 11, mandible; 12, first maxilla; 13, second maxilla; 14, maxilliped; 15, first swimming leg, anterior view; 16, second swimming leg, anterior view. (All figures were drawn with the aid of a camera lucida. Scale A applies to Figs. 1, 3, 4, and 21; scale B to Figs. 2, 5, 6, 9, 15–18, 23, 25–27, and 42–46.)



FIGS. 17–27.—*Nitocra medusaea*, n. sp., female: 17, Third swimming leg, anterior view; 18, fourth swimming leg, anterior view; 19, fifth leg; 20, sixth legs and opening of reproductive system on ventral surface of genital segment. Same, male: 21, fifth legs, genital segment, and abdomen, ventral view; 22, first antenna; 23, first swimming leg, anterior view; 24, spine on inner distal corner of basipodite of first swimming leg; 25, second swimming leg, anterior view; 26, third swimming leg, anterior view; 27, fourth swimming leg, anterior view. (Scale C applies to Figs. 7, 24, and 31; scale D to Figs. 10–14, 19, 20, 22, 28, 36, 37, 60, and 62.)

and an exopodite of a single podomere bearing three terminal setae.

The mandible (Fig. 11) has a swollen basipodite with a long slender masticatory lobe and a palp of two podomeres. The first and second maxillae are as illustrated in Figs. 12 and 13. The maxilliped (Fig. 14) consists of an elongated basipodite bearing a single feathered seta distally and a single endopodite podomere having a long prehensile claw at the distal end.

The first four pairs of swimming legs have rami of three podomeres. The first pair of legs (Fig. 15) is somewhat smaller than the succeeding pairs. The coxopodite is armed on the outer anterior surface by a group of spines, on the outer posterior surface by two groups of fine hair-like setae (present on all four swimming legs), on the mid-anterior surface by a transverse row of fine setae, and on the inner lobe by a row of small spines. The basipodite bears externally a finely denticulate spine, with a row of spines near its base, another row of spines along the distal edge of the basipodite between the bases of the two rami, and a large spine with smaller spines at its base on the inner distal corner. The middle podomere of the exopodite bears an inner seta. The first podomere of the endopodite bears an inner distal seta and is about as long as the first two exopodite podomeres together. The distal two endopodite podomeres combined are shorter than the first podomere, so that the entire endopodite is slightly shorter than the exopodite.

The coxopodite of the second pair of legs (Fig. 16) lacks the group of spines on the outer anterior surface and the transverse row of setae. The spines on the inner lobe are very slender and hair-like. There is no spine on the inner distal corner of the basipodite. The endopodite is distinctly shorter than the exopodite. The coxopodite of the third pair of legs (Fig. 17) is armed only with two groups of fine hair-like setae on the posterior outer surface. The outer corner of the basipodite bears a seta raised on a short pedicel, instead of a spine. The coxopodite and basipodite of the fourth pair of legs (Fig. 18) are armed like the third pair. The setal formula for the first our pairs of legs is:

	Leg 1		Leg 2		Leg 3		Leg 4	
	Exp.	End	Exp.	End	Exp.	End	Exp.	End
1st podomere	1:0	0:1	1:0	0:1	1:0	0:1	1:0	0:1
2d podomere	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1
3d podomere	5	3	7	4	7	5	7	5

The proximal podomere of the fifth pair of legs (Fig. 19) has an outer pedicellate seta and an inner swollen lobe bearing five setae, the three inner ones being shorter and of about equal length. Adjacent to the outermost seta on the lobe there is a row of 2–4 short spines. Along the almost straight inner edge of the lobe there are several small spines. The inner lobes of the two fifth legs are not united medially. The distal podomere is slightly longer than wide, with the outer edge nearly straight and the inner edge expanded. Distally there are five setae, the next to the innermost one being over twice as long as any of the others. Along the outer edge there are two groups of small spines, and on the inner edge there is a row of 5–6 slender spines. The sixth pair of legs is represented by a single small seta at either side of the opening of the oviduct (Fig. 20), visible on the anterior ventral part of the genital segment.

Male.—In general appearance the male resembles the female, but the body is distinctly smaller. The total length, based on five specimens, is 0.62 mm (0.60–0.64 mm). The ratio of length of the head (plus rostrum) and the first five leg-bearing thoracic segments to the genital segment and abdomen (plus caudal rami) is 37:25. The abdomen is 4-segmented. The actual and proportional lengths of the rostrum, body segments, and caudal rami are:

Rostrum	Head plus somite of leg 1	2	3	4	5	6	1	2	3	4	Caudal rami
22μ	140	57	50	52	49	53	52	48	43	38	18
3	23	9	8	8	8	9	8	8	7	6	3 = 100

The greatest body width is 157μ at the level of the first leg-bearing thoracic segment. The length of the inner long seta on the caudal ramus is 337μ.

The head and first four leg-bearing thoracic segments have a setal ornamentation much like that in the female. On the fifth leg-bearing thoracic and genital segments (Fig. 21) a row of small setae passes around the posterior dorsal area from the base of one leg to the corresponding leg on the opposite side, leaving the area between the bases of the legs free of setae. Both first and second abdominal segments have a transverse row of setae encircling the posterior region of the somite. The third segment has a similar transverse row and in addition a short row on each side of the somite. The last abdominal

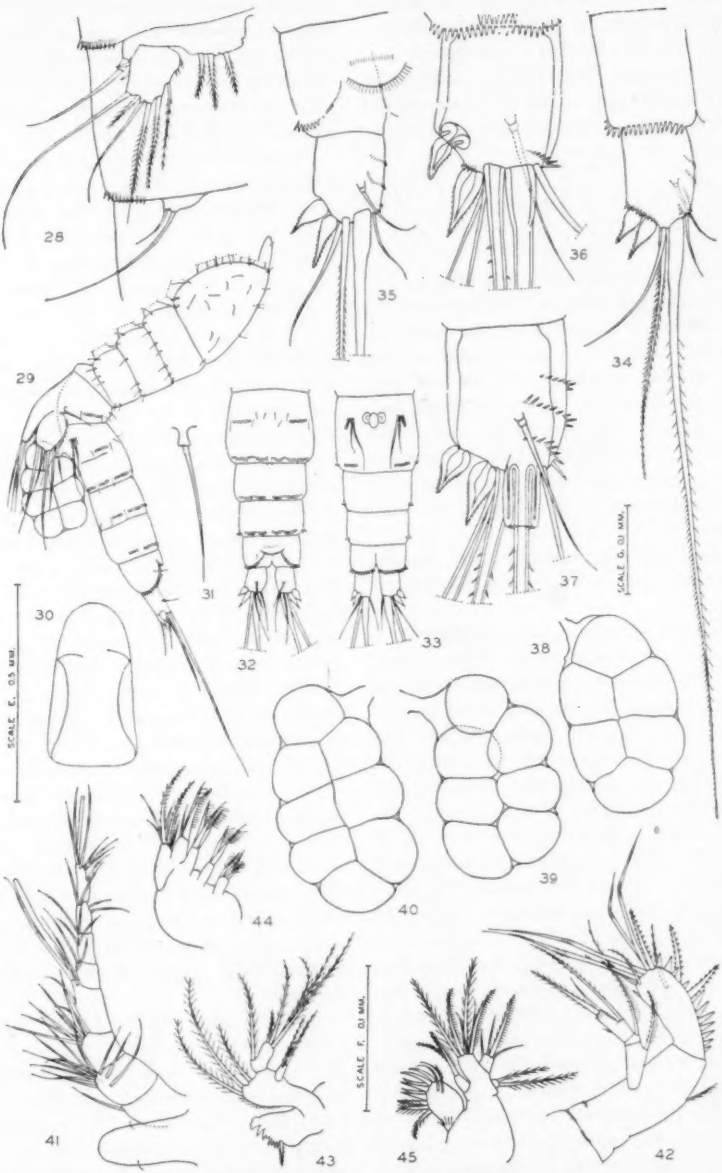


FIG. 28.—*Nitocra medusaea*, n. sp., male: fifth and sixth leg.

FIGS. 29–45.—*Mesamphiascus ampullifer*, n. sp., female: 29, lateral view; 30, rostrum, dorsal view; 31, a seta from the posterior border of a thoracic segment; 32, genital segment and abdomen, dorsal view; 33, genital segment and abdomen, ventral view; 34, part of last abdominal segment and caudal ramus, ventral view; 35, part of last abdominal segment and caudal ramus, dorsal view; 36, caudal ramus, showing partly retracted flask-shaped seta, ventral view; 37, caudal ramus, showing partly retracted long terminal seta, dorsal view; 38, egg sac with 6 eggs, lateral view; 39, egg sac with 7 eggs; 40, egg sac with 8 eggs; 41, first antenna and rostrum; 42, second antenna; 43, mandible; 44, first maxilla; 45, second maxilla. (Scale E applies to Figs. 29, 32, 33, and 54–56; scale F to Figs. 34, 35, 41, 47–53, 57–59, 61, and 63; scale G to Figs. 38–40.)

segment has two lateral rows and a transverse ventral row. The armature of the anal operculum and caudal rami is like that of the female.

The first antenna (Fig. 22) has eight podomeres of the following actual and proportional lengths (measuring along the outer margins):

1	2	3	4	5	6	7	8
22μ	25	7	28	21	21	11	10
15	18	4	19	15	14	8	7 = 100

The first and second podomeres both bear a single feathered seta as in the female. The inner margins of podomeres three, four, and five are thickened and irregular, the last two with processes bearing a row of small spines. From the distal edge of the fourth podomere arises an aesthetask 118 x 6μ, extending far beyond the end of the antenna. When the antenna is bent in the usual geniculate position, the aesthetask is equal in length to the antenna from its base to the outer angle of flexure.

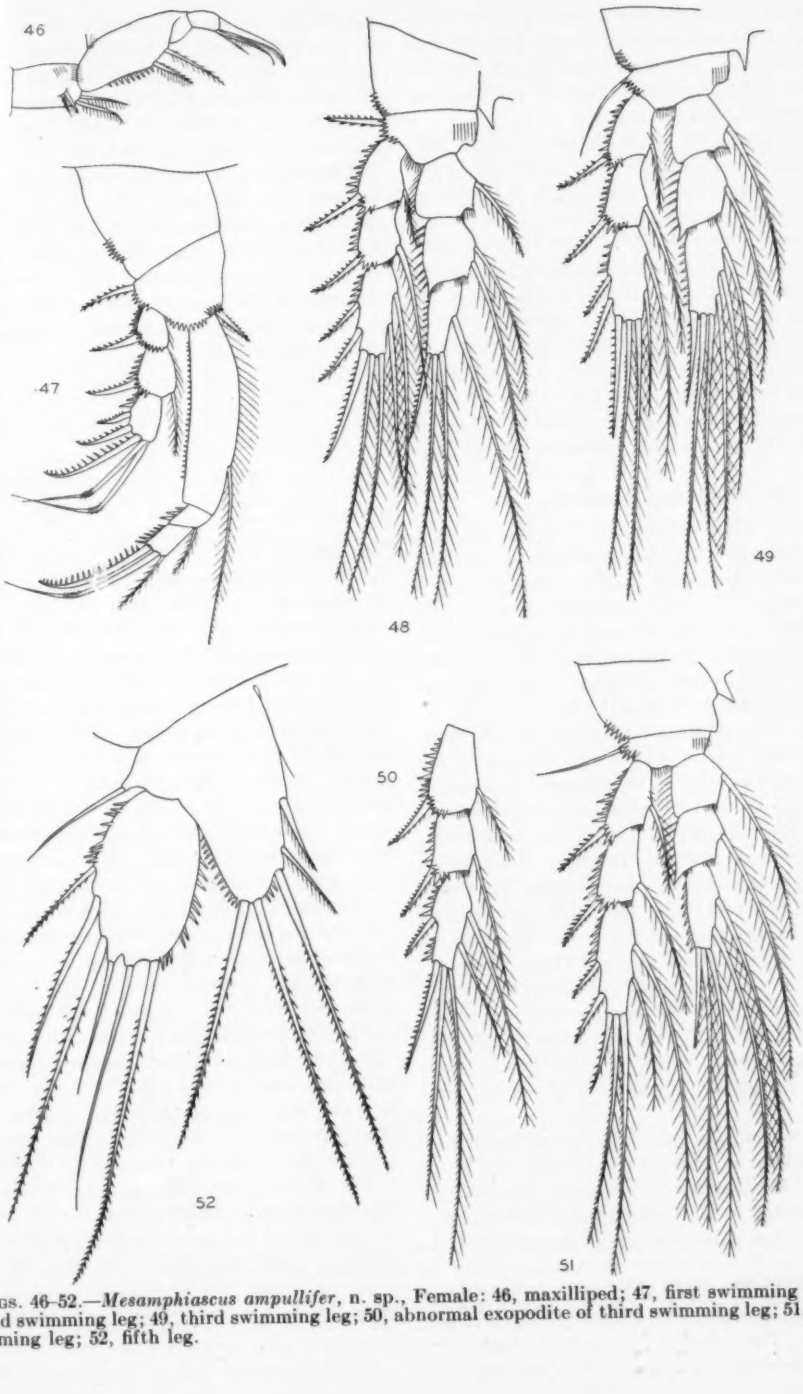
The second antenna, mandible, first maxilla, second maxilla, and maxilliped are like those of the female.

The first pair of swimming legs (Fig. 23) is armed in most respects like that of the female, except for the coxopodite lacking the transverse row of small setae on the anterior surface and the basipodite having the inner spine modified. The form of the spine (Fig. 24) might be described as subchelate. There is no indication, however, that the finger is movable. A row of small spines occurs near the base of this modified spine. The second pair of legs (Fig. 25) is in all important features of armature like that of the female. The third pair of legs (Fig. 26) is also similar to that of the female, except that the middle seta on the end of the last endopodite podomere is less than half as long as in the female. The fourth pair of legs (Fig. 27) resembles closely that of the female, even to the extent of having the next to the innermost seta on the last podomere of the exopodite characteristically spined, whereas in the second and third legs it is coarsely feathered. The setal formula for the four pairs of swimming legs is identical with that given for the female.

The proximal podomere of the fifth pair of legs (Fig. 28) bears an outer pedicellate seta and an expanded inner lobe bearing three feathered setae in a row. The inner lobes of the two fifth legs are not united medially. The distal podomere is slightly longer than wide, of a somewhat irregular shape, bearing six setae along the distal edge as indicated in the figure. A group of small spines occurs on the inner edge and two larger spines on the outer edge. The sixth pair of legs (Fig. 28) is represented by a low expansion bearing two unequal setae at the outer distal corner.

Remarks.—According to Lang (1948) there are eighteen certain species in the genus *Nitocra*. *Nitocra medusaea*, with the first endopodite podomere of the first leg of the female shorter than the exopodite, differs from *N. typica* Boeck, *N. pontica* (Jakubisiak), *N. pusilla* Sars, *N. mediterranea* (Brian), *N. hibernica* (Brady), *N. affinis* Gurney, *N. elegans* (T. Scott), and *N. minor* Willey, which have that podomere at least as long as the exopodite. Having the terminal podomere of the endopodite of the first leg of the female about as long as the middle podomere, it differs from *N. bdellurae* (Liddell), in which the terminal podomere is twice as long as the middle one. In having six setae on the distal podomere of the fifth leg in the female, it is unlike *N. fallaciosa* Klie and *N. fragilis* Sars, which have five. With the first podomere of the endopodite of the first leg of the female about as long as the first two exopodite podomeres, it differs from *N. lacustris* (Schmankevitsch), *N. spinipes* Boeck, *N. dubia* Sars, and *N. platypus* Daday, in which it is distinctly shorter than the two exopodite podomeres. In having three setae on the inner expansion of the proximal podomere of the fifth leg in the male, it differs from *N. malaica* Kiefer and *N. sewelli* Gurney, which have only two. With the caudal rami slightly wider than long, it is unlike *N. divaricata* Chappuis where they are 1.5–2 times longer than wide. Other differences are also to be found, but the single characters selected above serve to distinguish each already known species from *N. medusaea*.

Nitocra chelifer Wilson (1932) is thought by Lang (1948) to represent a mixture of at least two species, the male being a *Nitocra* perhaps identical with *hibernica*, and the female being probably a *Proameira*. The taxonomic uncertainty is difficult to clarify because of the existence of only two known specimens, a holotype male and a paratype female, both undissected, in the U. S. National Museum. The female, however, differs from *N. medusaea* in having the terminal podomere of the endopodite of the first leg narrow and more than twice as long as the middle podomere. The male differs from the new



FIGS. 46–52.—*Mesamphiascus ampullifer*, n. sp., Female: 46, maxilliped; 47, first swimming leg; 48, second swimming leg; 49, third swimming leg; 50, abnormal exopodite of third swimming leg; 51, fourth swimming leg; 52, fifth leg.

species in having the first podomere of the endopodite of the first leg much longer than the first two exopodite podomeres and in having five setae on the inner expansion of the proximal podomere of the fifth leg.

Members of the genus *Nitocra* occur in fresh, brackish, or salt water. Two species are known to be semiparasitic. *N. bdellurae* lives in the egg capsules of *Bdelloura propinqua* Wheeler and *B. candida* (Girard), flatworms which live upon the carapace of the horseshoe crab, *Limulus*. There it feeds on the embryos of the worms, according to Liddell (1912). *N. divaricata* lives in the gill chambers of crayfishes, *Astacus fluviatilis* according to Chappuis (1926) and *A. leptodactylus* according to Jakubisiak (1939). *Nitocra medusaea* is thus the third species in the genus known to have definite semiparasitic relationships.

Mesamphiascus ampullifer, n. sp.

Several hundred specimens of this copepod were recovered from the mouthparts of eight small adult American lobsters, *Homarus americanus* Milne-Edwards, purchased alive on July 30, 1952, from a lobster market at Portsmouth, N. H. Except for the statement of the proprietor that all the lobsters had been caught locally in the vicinity of Portsmouth, their origin is uncertain. The copepods, including nauplii, copepodids, and adults, were found clinging to the many hairlike setae on the flattened inner edges of the proximal endite lobes (presumably belonging to the coxopodites) of the first maxillipeds. They occurred nowhere else unless disturbed by probing with a needle or intense light. Then they crawled actively over the other mouthparts, reminding one very much of lice as they crawled among the setae of these appendages. When removed to a watch glass of sea water, they swam vigorously at first, but soon came to rest on the bottom of the dish, from which they would then only sporadically arise to swim freely. Their behavior toward light seemed to be slightly negative.

The type material consists of a holotype female (No. 95308), an allotype (No. 95309), and paratypes (150 females and 100 males, No. 95310), all deposited in the United States National Museum. Other paratypes are in the author's collection.

Female.—The body (Fig. 29), excluding the intestinal contents, is colorless except for a bright red eye. The intestine of specimens freshly removed from the host is pale yellow and may contain reddish or orange droplets, conferring a tinge of color to the animal. The total length (measuring from the tip of the rostrum to the posterior end of the caudal rami), based on five specimens, is 1.041 mm (0.975–1.081 mm). The ratio of length of the head (plus rostrum) and the first five leg-bearing thoracic segments to the genital segment and abdomen (plus caudal rami) is 60:44. The genital segment shows a slight indication of subdivision into two segments, marked by weak lateral furrows and a row of setae. The abdomen is 3-segmented. The actual and proportional lengths of the rostrum, body segments, and caudal rami are:

Rostrum	Head plus somite of leg 1	2	3	4	5	6	1	2	3	Caudal rami
73μ	268	78	79	66	34	130	97	85	65	65
7	26	8	8	6	3	13	9	8	6	6 = 100

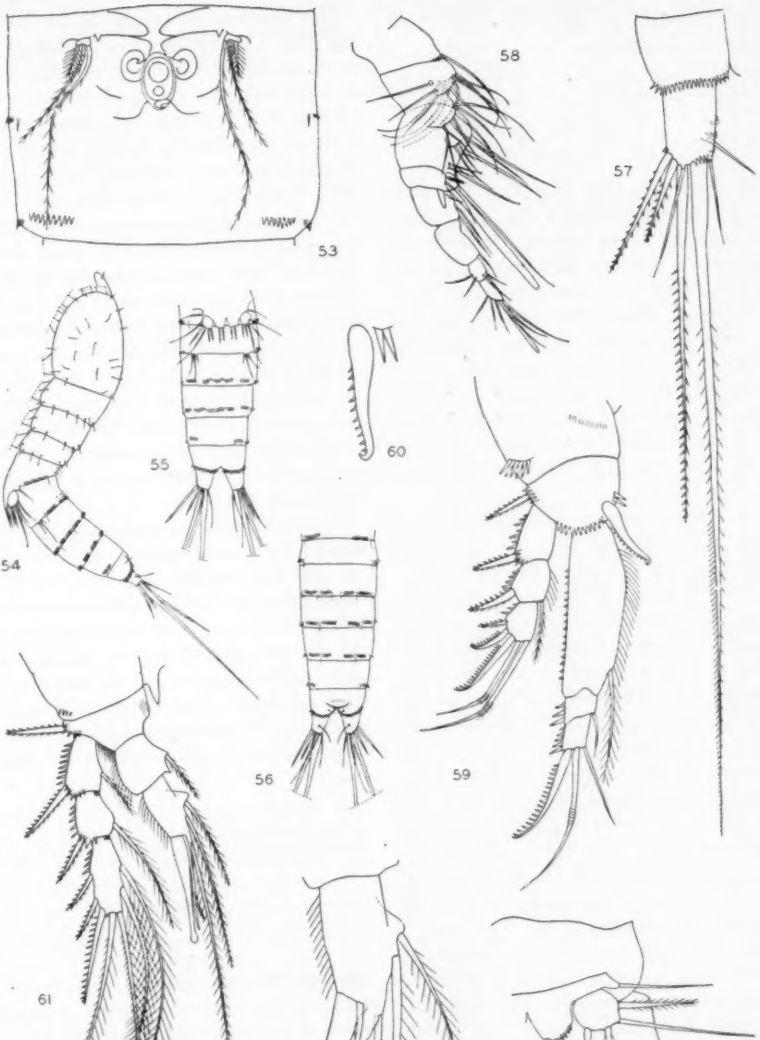
The greatest body width is 188μ at the level of the first leg-bearing thoracic segment. Length of longest seta on caudal ramus is 430μ.

The rostrum (Fig. 30) curves slightly downward, tapering to a blunt, rounded end and bearing two small setae on the dorsal surface. The head and first four leg-bearing thoracic segments bear minute setae (many only 10μ long) as shown in Fig. 29. Many of the setae on the posterior borders of these segments arise from slender pedicels (Fig. 31). The fifth leg-bearing thoracic, genital, and abdominal segments are armed with setae as indicated in Figs. 29, 32, and 33. The anal operculum bears a row of fine setae distally.

The caudal ramus (Figs. 34 and 35), about twice as long as wide, bears two flask-shaped setae at the outer distal corner. The base of the longest terminal seta is slightly swollen. On the dorsal surface of the ramus there is a small seta with a 2-jointed pedicel. Three oblique rows of small spines pass around the inner margin of the ramus. Both the flask-shaped setae and the longest terminal seta may be partially retracted as in Figs. 36 and 37 respectively. The remaining setae of the ramus are indicated in the figures.

The two egg sacs (Fig. 38), each about 47 x 32μ, are laterally flattened and extend only to a little beyond the middle of the first abdominal segment. Each sac usually contains six eggs, each egg about 50μ in diameter. Occasionally there are seven eggs (Fig. 39) or eight eggs (Fig. 40).

The first antenna (Fig. 41) has eight podomeres



FIGS. 53–63.—*Mesamphiascus ampullifer*, n. sp., female: 53, Genital segment, ventral view, showing reproductive opening and sixth legs. Same, male: 54, lateral view, head and thoracic appendages omitted; 55, fifth legs, genital segment, and abdomen, ventral view; 56, genital segment and abdomen, dorsal view; 57, part of last abdominal segment and caudal ramus, ventral view; 58, first antenna; 59, first swimming leg; 60, inner basipodite spine and associated spines on first leg; 61, second swimming leg; 62, distal endopodite podomere of second leg; 63, fifth and sixth legs.

with the actual and proportional lengths as follows:

1	2	3	4	5	6	7	8
32μ	27	28	28	17	18	20	27
16	14	14	14	9	9	10	14 = 100

The entire antenna is 197μ long. On the fourth podomere there is an aesthetask 73μ long, reaching to about the tip of the antenna. On the distal podomere there is a second aesthetask, slenderer than the previous one, and about 38μ long. There are no feathered setae. The second antenna (Fig. 42) bears an exopodite of three podomeres, the middle one of which has a single seta.

The mandible (Fig. 43) has a small exopodite and endopodite, both of a single podomere. The first and second maxillae are as shown in Figs. 44 and 45. The maxilliped (Fig. 46) bears a pectinate claw distally.

The first four pairs of legs have rami of three podomeres. In the first pair (Fig. 47) the exopodite is only one-half as long as the endopodite. The coxopodite bears a row of spines on the outer distal area. The basipodite bears an inner and an outer seta, with smaller spines as indicated in the figure. The middle podomere of the exopodite bears a single seta. The first podomere of the endopodite is much longer than the entire exopodite, while the two distal segments are short, the proportions of the three being about 77:9:14. The basipodite of the second pair of legs (Fig. 48) lacks the inner spine, there being a row of slender setae near that point. The third pair of legs (Fig. 49) is in most respects similar to the second, except for an increase in the number of setae on the endopodite as indicated in the table below. In a single specimen an abnormal exopodite (Fig. 50) with only six setae instead of seven on the terminal podomere was noted, the exopodite of the opposite side being normal. The fourth leg (Fig. 51) closely resembles the third except for one less seta on the terminal endopodite podomere.

The setal formula for the first four pairs of legs is:

	Leg 1		Leg 2		Leg 3		Leg 4	
	Exp.	End	Exp.	End	Exp.	End	Exp.	End
1st podomere	1:0	0:1	1:1	0:1	1:1	0:1	1:1	0:1
2d podomere	1:1	0:1	1:1	0:2	1:1	0:1	1:1	0:1
3d podomere	5	3	7	4	7	6	7	5

The proximal podomere of the fifth pair of legs (Fig. 52) has an outer pedicellate seta and an elongated lobe bearing five setae plus a row of small spines along its distal edge. The two lobes of the right and left sides are not fused medially. The distal podomere is in the shape of an elongated oval, with the length to width as 15:9. There are six setae along the distal edge, the two nearest the innermost seta being slender and without lateral spines. Of these two slender setae the outer one is characteristically only a little more than one-half as long as the inner one. Both inner and outer edges of this podomere proximal to the large distal spines are armed with groups of small spines. A sixth pair of legs (Fig. 53), each leg consisting of a minute base bearing three setae, is present on either side of the genital opening. Of these three setae the innermost is the longest and the outermost is relatively short with long lateral hairs.

Male.—In general appearance the male resembles the female, except for the smaller body size and the modified first antennae. The total length, based on five specimens, is 0.88 mm (0.87–0.89 mm). The ratio of the head (plus rostrum) and the first five leg-bearing thoracic segments to the genital segment and abdomen (plus caudal rami) is 52:36. The abdomen (Fig. 54) is 4-segmented. The actual and proportional lengths of the rostrum, body segments, and caudal rami are:

Rostrum	Head plus somite of leg 1	2	3	4	5	6	1	2	3	4	Caudal rami
62μ	238	67	64	56	30	54	66	68	66	57	40
7	27	8	7	6	3	6	8	8	8	7	6 = 100

The greatest body width is 157μ at the level of the first leg-bearing thoracic segment. The length of the inner long seta on the caudal ramus is 415μ.

The head and first four leg-bearing thoracic segments bear small setae as indicated in Fig. 54. These setae are arranged in general like those of the female. The fifth leg-bearing thoracic, genital, and abdominal segments are armed as shown in Figs. 54, 55, and 56. The arrangement of the seven major setae on the caudal ramus (Fig. 57) is like that of the female. Instead of the two flask-shaped setae on the outer distal corner, however, there are two tapering setae with minute lateral spines.

The first antenna (Fig. 58) has eight podomeres of the following actual and proportional lengths (measuring along the outer margins):

1	2	3	4	5	6	7	8
20μ	34	30	13	29	30	13	19
14	17	19	6	14	15	6	9 = 100

On the inner edge of the fourth podomere there is a minute feathered seta. From this region there arises also an aesthetask about 77μ long. A second aesthetask much slenderer and about one-half as long is borne on the end of the distal podomere. Podomeres 3–6 have irregular chitinized processes along their inner surfaces. The third podomere is noticeably swollen. The second antenna, mandible, first maxilla, second maxilla, and maxilliped are like those of the female.

The first swimming leg (Fig. 59) has proportions and armature much like the female. The inner basipodite spine, however, is hooked at its tips and bears a row of minute spines along the edge (Fig. 60). Near its base there are two smaller spines. The second swimming leg (Fig. 61) differs from the first, third, and fourth in that the endopodite has apparently two podomeres, the second and third podomeres having become fused. The six setae on the distal endopodite podomere (Fig. 62) may be homologized with the setae of the second and third podomeres of the female endopodite. The two setae on the middle inner edge correspond to the two belonging to the second podomere in the female. The long feathered seta distal to these two corresponds to the seta arising from the middle inner edge of the third podomere of the female. The three greatly modified terminal setae correspond to the three terminal setae of the female. The third and fourth swimming legs are like those of the female.

The setal formula for the first four pairs of legs is:

	Leg 1		Leg 2		Leg 3		Leg 4	
	Exp.	End	Exp.	End	Exp.	End	Exp.	End
1st podomere.....	1:0	0:1	1:1	0:1	1:1	0:1	1:1	0:1
2d podomere.....	1:1	0:1	1:1	6	1:1	0:1	1:1	0:1
3d podomere.....	5	3	7		7	6	7	5

The proximal podomere of the fifth leg (Fig. 63) bears an outer pedicellate seta and an inner lobe with two setae and a row of small spines. The distal podomere is slightly wider than long, the two dimensions being in the proportion of 11:9. It bears four setae, the seta next to the outermost being longest and without lateral hairs. The sixth leg (Fig. 63) consists of three setae arising from a low ridge along the posterior margin of the genital segment.

Remarks.—Although *M. ampullifer* has certain very distinctive features, such as the sexual dimorphism of the two outer setae on the caudal rami, its generic position may be subject to at least two interpretations of the species in the Diosaccidae. Lang (1948) described sixteen new genera in the family, bringing the total to twenty-seven. *M. ampullifer* possesses characteristics which seem to be of taxonomic importance equal to those used to separate genera within the family. It does not seem possible, therefore, to place this new species in any of the genera recognized by Lang.

It is possible, however, to place the new species in the genus *Mesamphiascus* Nicholls. In his revision of the Diosaccidae Nicholls (1941) erected the subfamily Amphiascinae, basing his concept upon the setation of the middle podomeres of the second and third endopodites. In this subfamily he placed *Robertsonia* Brady, *Schizopera* Sars, *Amphiascopsis* Gurney, *Amphiascus sens. str.*, and the new genera *Amphiascoides* and *Mesamphiascus*. The last named genus he described as having two inner setae on the middle podomere of the second endopodite and one inner seta on the middle podomere of the third endopodite. *Mesamphiascus* as thus defined by him included twenty-six species, the type selected being *Amphiascus parvus* Sars. Until more is known about the species of the Diosaccidae and their true generic relationships can be interpreted, it seems better to place this new species from the lobster in *Mesamphiascus* Nicholls than to erect a new genus for it.

M. ampullifer may be distinguished from the recognized species of *Mesamphiascus* by the flask-shaped setae on the caudal rami of the female. Only one other species in the genus *M. bulbifer* (Sars) has setae on the caudal rami modified in a similar manner. In this species, however, it is the outer of the two long setae which is modified, not the two setae at the outer distal corner as in *M. ampullifer*. Whether or not this modification is sexually dimorphic as in *M. ampullifer* is not known, since only females of *M. bulbifer* have been described. Sexual dimorphism, however, is known in a few other

harpacticoid genera, such as *Attheyella* and *Huntemannia*. Basal swelling or expansion of the setae on the caudal rami has been described in many harpacticoids, as discussed by Sewell (1940), but usually the two long setae are the ones affected and often it is not clear whether the condition is sexually dimorphic. Swollen setae on the outer distal corner of the caudal ramus are not entirely unknown in other harpacticoids, one having been described by Klie (1929) in the female of his *Paramesochra holsatica*.

M. ampullifer differs further from all other species in the genus in the character of the inner basipodite seta of the first leg of the male and in the armature of the endopodite of the second leg of the male. It seems also to be unlike most other known species in having a small aesthetask on the terminal podomere of the first antenna. This feature, however, may be common to other species. Such an aesthetask is apparently figured by Sewell (1940) in his new species *Amphiascus calcarifer*, f. *major*, though not mentioned in the text. The aesthetask is so small that in the group of terminal setae it might easily be overlooked.

The majority of the members of the Diosaccidae for which ecological information is available are free-living, in salt, brackish, or fresh water. Numerous species of marine harpacticoids have been found by Jakubisiak (1932 and 1936) among the algae and animal colonies attached to the carapace of the crab, *Maia squinado* (Herbst), among them *Diosaccus tenuicornis* (Claus), *Amphiascopsis phyllopus* (Sars), *Mesamphiascus parvus* (Sars), *Amphiascoides debilis* (Giesbrecht), and *Amphiascoides hispidus* (Norman MS, Sars). These five species of Diosaccidae also occur, however, in sand and among algae, being found normally in the latter habitat, according to Monard (1935). They probably live not as true commensals or as semiparasites but as free animals in the ecological niche provided by the thick growth on the crab carapace. Another species, *Amphiascoides commensalis* (Seiwell), lives as a commensal in the branchial chamber of the ascidian, *Amaroucium*, according to Seiwell (1928). *M. ampullifer* thus appears to be the second species in the Diosaccidae known to have definite relationships with a host animal, although its morphological modifications for clinging to the host are not highly developed.

The only other harpacticoid known from the lobster is *Unicalteutha ovalis* Wilson, 1944 (Peltidiidae). This copepod occurs commonly on lobsters in Newfoundland (Templeman and Tibbo, 1945), where it is found chiefly in restricted areas on the chelipeds.

After the above description had been completed, twelve preserved lobsters, comprising nine females and three males, were found parasitized by *M. ampullifer*. These lobsters had been used for class study for five years and their collection locality is unknown. Three of the females and two of the males had many nauplii and copepodids as well as adults. All stages of the copepods were confined to the setose flattened edges of the proximal endite lobes of the first maxillipeds.

Nine live lobsters, including four males and five females, collection locality unknown, purchased from a Boston fish market in March, 1953, were also parasitized by these copepods. Over 100 copepods, including nauplii, copepodids, and adults, were removed from each. From one female 370 adult copepods were recovered. When it is considered that the combined area of the flattened edges of the two endite lobes where they were clinging was not more than about 28 square millimeters, the heavy degree of infestation may be appreciated.

M. ampullifer seemed to be particularly hardy when removed from the host, since some individuals survived for 41 days at about 70 degrees F. in a watch glass of sea water changed weekly but without special aeration.

M. ampullifer thus appears to be a common parasite of lobsters in the New England area, since it has been found on all 29 thus far examined. This, together with the fact that it occurs in such large numbers and on such a restricted part of the host's body, would tend to support the conclusion that it normally lives upon the lobster.

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ZOOLOGY.—*A burrowing barnacle of the genus* Trypetesa (order Acrothoracica).[1]

JACK T. TOMLINSON, Department of Zoology, University of California. (Communicated by Fenner A. Chace, Jr.)

A previously unreported acrothoracican barnacle has been found burrowing in *Tegula* shells occupied by hermit crabs in the intertidal zone of central California. A description and certain aspects of the life history of this form are given. A more detailed morphological study is in preparation for future publication.

Subclass CIRRIPEDIA (Lam.) Burmeister, 1834

Order ACROTHORACICA Gruvel, 1905

Diagnosis.—Boring cirripeds with soft mantle without calcareous plates; cirri reduced, concentrated toward posterior end of body, one pair in vicinity of mouth ("mouth cirri"), and widely separated from other pairs, remaining pairs 2, 3, or 4 in number. Three pairs of mouth appendages. Abdomen lacking (?). Hermaphroditic or sexes separate. Males dwarf. Ovaries in a more or less flattened part of mantle ("disk"), which serves at same time to anchor it in the hole. Development always includes a cypris stage, with a nauplius stage in most of the species studied. Live buried in chiton and barnacle plates, gastropod shells, and corals.

Suborder Apygophora Berndt, 1907

Diagnosis.—Sexes separate. Female: An external chitinous mantle "sack" more or less regularly rounded or oval serving to fix the animal in a burrow in a shell; one pair of biramous mouth cirri; three pairs of quadriarticulated and uniramous thoracic cirri, the first two pairs possessing small prickly pads on second articulation; two lateral folds on inside of mantle which are perhaps ovigerous frenae; alimentary canal a sacculated system without an anus; esophagus spineless; nervous system consists of brain and one ventral ganglion.

Rudimentary (dwarf) males: Small, fixed on upper part of disk of female or grouped on cavity in shell; in the form of an elongated bag, naked and transparent; with a small opening for passage of a well-developed probosciform penis; only eyes, testis, seminal vesicle, and penis are developed.

Cyprid larvae with six pairs of thoracic appendages biramous and natatory; abdominal segment with two large appendages.

Family Trypetesidae Kruger 1940 (=Alcippidae Gerstäcker, 1866; Gruvel, 1905).

With the characteristics of the suborder

Genus **Trypetesa** A. M. Norman, 1903

(=*Alcippe* Hancock, 1849; Darwin, 1854; Berndt, 1903, 1907; Genthe, 1905; Kuhnert, 1935; *Alcippoides* E. Strand, 1928. *Non Alcippe* Blyth, 1844.)

Trypetesa lampas (Hancock)

"Capitulum" laterally compressed, perpendicular to surface of the shell, with "disk" or ovigerous portion dorsoventrally compressed and

[1] This work was completed in partial satisfaction of the requirements for the degree of master of arts in zoology at the University of California, under the supervision of Dr. Willard D. Hartman, to whom I am indebted for encouragement and assistance.

parallel to surface of host shell; nauplius free-swimming; adult exceeding 8 mm; bilaterally symmetrical; male attached only to disk of female; reported from the sublittoral of the northern Atlantic Ocean and the Mediterranean Sea.

Trypetesa lateralis, n. sp.

Laterally compressed throughout; no free-swimming nauplius; adult does not exceed 5 mm; not bilaterally symmetrical in mantle structure (lips of mantle opening asymmetrical; with a large external flap on left side of mantle only); male attached to disk of female or to the cavity wall near the external flap; found in littoral zone of central California.

Diagnosis.—Female laterally compressed throughout and situated laterally to right of slit in host shell, relative to point of attachment; "horny knob" of disk relatively small, on a recognizable stalk or peduncle; size not in excess of 5 millimeters; flap on the left surface of the mantle extends in adult to external surface of host shell, which it minutely perforates; retains young to cyprid stage; body proper resembles that of *Trypetesa lampas*, but much smaller; mantle sac not bilaterally symmetrical (Fig. 1); males may be numerous and attached to horny disk or knob of female or grouped on wall of cavity near external mantle flap.

The species is named for the wholly laterally compressed body and the orientation of the animal within the shell, laterally from the aperture.

Type specimen.—U. S. National Museum no. 93450.

Type locality.—Moss Beach, San Mateo County, Calif.

Dimensions of type.—Maximum diameter, 3.2 mm; right lip length 1.1 mm; dimension "A" (see Fig. 7), 1.85 mm; dimension "B", 2.7 mm.

Repositories of other type material.—California Academy of Sciences, San Francisco, Calif., no. 9857; Allan Hancock Foundation, University of Southern California, Los Angeles, Calif.; University of California Museum of Paleontology, Berkeley, Calif., no. 32960.

Distribution.—Point Arena, Mendocino County, Calif., to Shell Beach, San Luis Obispo County, Calif. (search for it was made at intervals from San Juan Island, Wash. to Ensenada, Baja California, Mexico. See Fig. 5). Intertidal. In *Tegula* shells occupied by all species of *Pagurus* within the range (all were in shells of *Tegula brunnea* and *T. funebralis* except for 3 *Calliostoma costatum* and 1 *Acanthina spirata*. Hermit crabs: *Pagurus granosimanus*, *P. hemphillii*; *P. hirsutiusculus*, and *P. samuelis*). A significant preference in the total sample for *T. brunnea* shells and for those occupied by *P. samuelis*. (This latter preferred association may result from the fact that *P. samuelis* is more abundant at the higher levels of the intertidal region where the barnacle itself is more abundant.

FIG. 1.—*Trypetesa lampas* (after Genthe) and *T. lateralis*.

ABBREVIATIONS USED IN FIG. 1

a—point of attachment.
ap—aperture of shell cavity.
c—capitulum.
e.m.f.—external mantle flap.
h.d.—horny disk.
h.k.—horny knob.
lip—lip or edge of mantle.
s.s.—shell surface (approx. relative position).
s.—slit (early aperture)

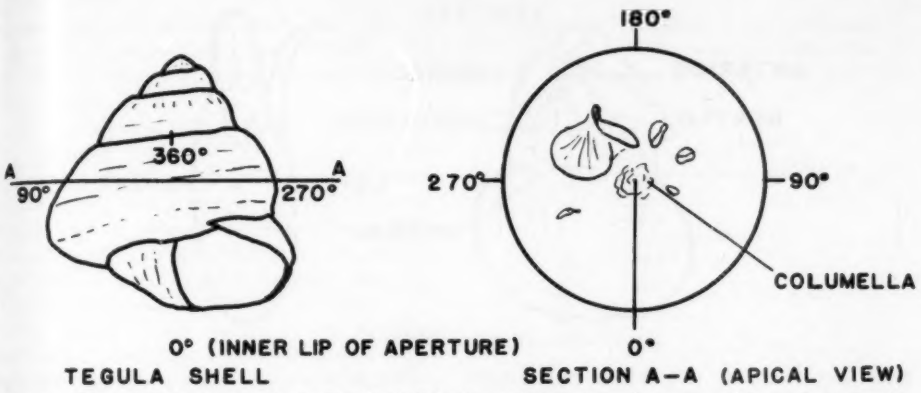

FIG. 2.—Plan of the body whorl of a *Tegula* shell to show the location of burrows of *Trypetesa lateralis*. Barnacles of different ages are shown.

At Haven's Neck, Mendocino County, *P. hemphillii* replaces *P. samuelis* in the higher zones, yielding evidence that the vertical zonation of the barnacle is dependent upon intertidal position rather than upon the species of hermit crab.) Specimens found in shells measuring from 7 to 16 mm in length of aperture; no correlation between size of shell and incidence of barnacles within the size range (over 1,000 shells examined).

Distribution within the shell: Of 1,315 barnacles 98.5 per cent were found in the body whorl with a slightly higher concentration at about 255° from the edge of the aperture (Fig. 2). They burrow on the posterior surface inside the shell (in the "floor" of the shell as viewed with the apex upward). The larvae apparently attach at random, but burrow with the point of attachment away from the columella. They may burrow entirely within the columella.

The flattened mantle is oriented parallel to the surface of the shell with its left side, bearing the external mantle flap, more deeply buried. The ovigerous "disk" extends to the right of the opening in the shell when viewed from the point of attachment (Fig. 1, 2).

Methods.—The study of this barnacle requires certain special methods because of its habit of living inconspicuously on the inside of the shell. The shell has to be broken to check for the presence of the barnacles, which are found to be almost totally confined to the body whorl. They are situated largely on the "floor" of the inside of the shell (with the apex upwards). Thus the tip or apex of the shell can readily be removed with a geologist's pick or chipping hammer without injury to the occupants. It is most satisfactory to remove the apex gently with the hermit crab alive and still in the shell. The crab is then pushed out of the shell with a bent wire or other probe.

If the shells cannot be opened soon after collection, they may be placed in 10 per cent formalin and kept for a short time. After such treatment the crabs may be removed most easily by pulling them bodily from the shell with curved forceps. Detached portions of abdomen may be removed after chipping off the apex of the shell. If the barnacles are to be saved, the crabs should be removed as soon as possible to allow the fixing fluid to penetrate to the barnacles.

The barnacles are located by a "candling" process in which the shell is illuminated from the apertural side by a narrow beam of light and viewed from the removed apical end. The barnacles appear as yellow, orange, or at times reddish areas with a definite outline, the latter depending upon their age. Very small ones appear as slitlike spots of light.

The adult barnacles adhere quite firmly to the shell, in part because they are cemented to it and in part through the action of the "teeth" or "thorns" by which they abrade the shell. The barnacles can be freed from the shell by placing them in a dilute (1 per cent or less) solution of hydrochloric acid in 70 per cent alcohol for a few days. Von Ebner's decalcifying fluid is also satisfactory. In a few days the overlying shell can be carefully picked away and the barnacle lifted out. Bouin's fluid is excellent for removing the larger barnacles in perfect condition, but many of the smaller animals are lost. In using this fixative the shells are covered with fluid

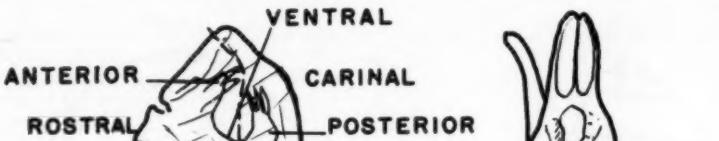

FIG. 3.—The orientation of *Trypetesa lateralis*.

until they are quite soft, which may require several changes of fluid. Jeweler's forceps are valuable in removing the smaller barnacles.

The collecting of the shells in the field was done under varying conditions of tide level and of depth at which the crabs were found. All

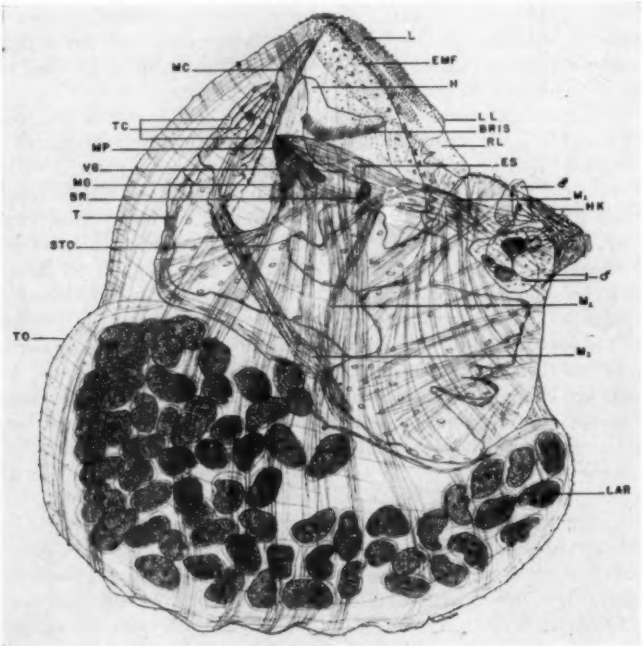

FIG. 4.—*Trypetesa lateralis*, n. sp. A mature female with three males attached. Left lateral view. Camera lucida drawing, × 92.

ABBREVIATIONS USED IN FIG. 4.

BR—Brain.
BRIS—Bristles on the side of the head.
EMF—External mantle flap.
ES—Esophagus.
H—Head.
HK—Horny knob.
L—Lip of the mantle.
LAR—Larva.
LL—Left lip.
LMF—Left internal mantle flap.
$M^{1,2,3}$—Muscles (numbered).
MC—Mouth cirrus.
MG—Maxillary gland.
MP—Mouth parts.
RL—Right lip.
STO—Stomach.
T—Thorax
TC—Thoracic cirri.
TO—Tooth.
VG—Ventral ganglion.
♂—Males.

hermit crabs were collected at random, with no selection for crab or shell types. The differences in the composition of these collections may be seen in Table 1.

Several hundred living *Tegula brunnea* and *T. funebralis* were collected at Moss Beach, San Mateo County, and inspected for specimens of *Trypetesa*, but none were found. Likewise examination of several hundred *Mytilus californianus* shells, living and dead, and of several specimens of large balanoid barnacles from the Monterey Peninsula revealed no *Trypetesa*.

The life cycle.—An analysis of the numbers and sizes of *Trypetesa lateralis* from collections at Moss Beach, San Mateo County, at different times of the year has been made to determine the life cycle. The percentage infection of shells, the average number of barnacles per infected shell, the percentage of larvae in the population, and the average size of the barnacles has been plotted (Fig. 6). Larval-sized barnacles have a slit length of 0.25 mm; when the barnacle starts to mature the slit rapidly becomes longer.

The results seem to indicate that the period of greatest larval settling is during the months of November, December, and January, and again to a lesser degree in June. An increase in the numbers of barnacles per infected shell and the percentage of larvae, with a concommitant decrease in the average barnacle size, give evidence for this larval settling. The drop in the percentage infestation of shells may indicate the breakdown of older shells with larger barnacles, resulting in a decrease in the average size and the increase in the percentage of larva. In the latter case the number of barnacles per infected shell should not increase, which it does. This increase favors the argument for the actual influx of larvae rather than the breakdown of shells.

The recruitment of young barnacles must be very rapid, for during the period of study the percentage of larval-sized barnacles did not fall below 50 per cent. This would imply a very high mortality of barnacles in proportion to the rate of growth. The data are not adequate for a determination of this factor. The life cycle of this barnacle is intimately associated with the length of time that the host shell remains intact. Information on this subject would be of great interest.

The growth of the females of *Trypetesa lateralis* is accompanied by molts, but distinct molt stages or instars are not evident from available data. The results of measurements of 152 barnacles along two axes have been plotted (Fig. 7). The diameter of the lips and disk was

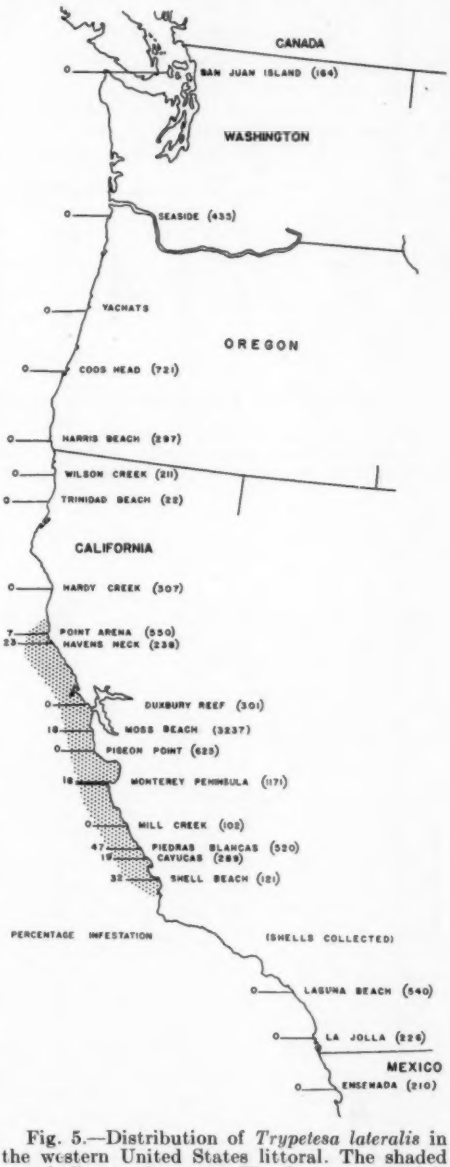

Fig. 5.—Distribution of *Trypetesa lateralis* in the western United States littoral. The shaded area indicates the range. The figures at the left indicate the percentage of infestation, while the figures in parentheses at the right denote the number of shell specimens collected. The double line at the Monterey Peninsula indicates extensive collections at several points.

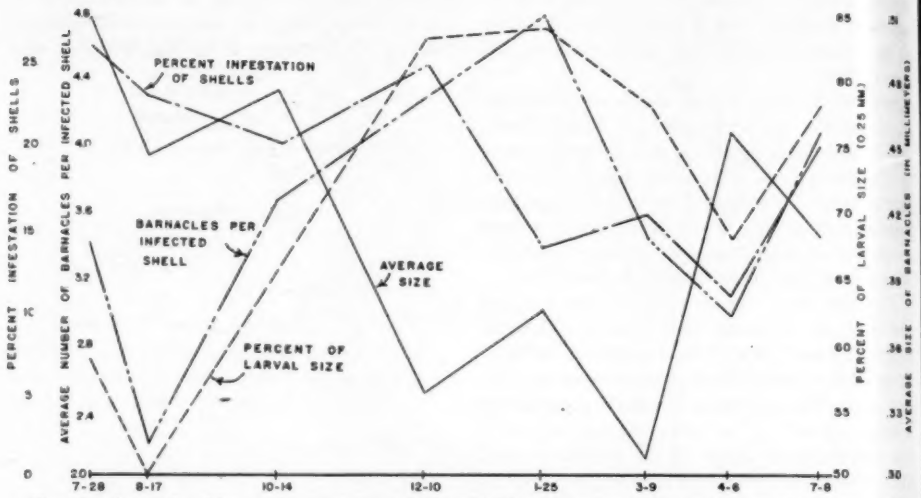

FIG. 6.—Analysis of barnacle numbers and sizes at Moss Beach at different times of the year. The *per cent larval size* is the percentage of the total barnacle sample which was of larval size, or 0.25 mm in slit length. The numbers on the abscissa indicate the month and day, 1951 to 1952.

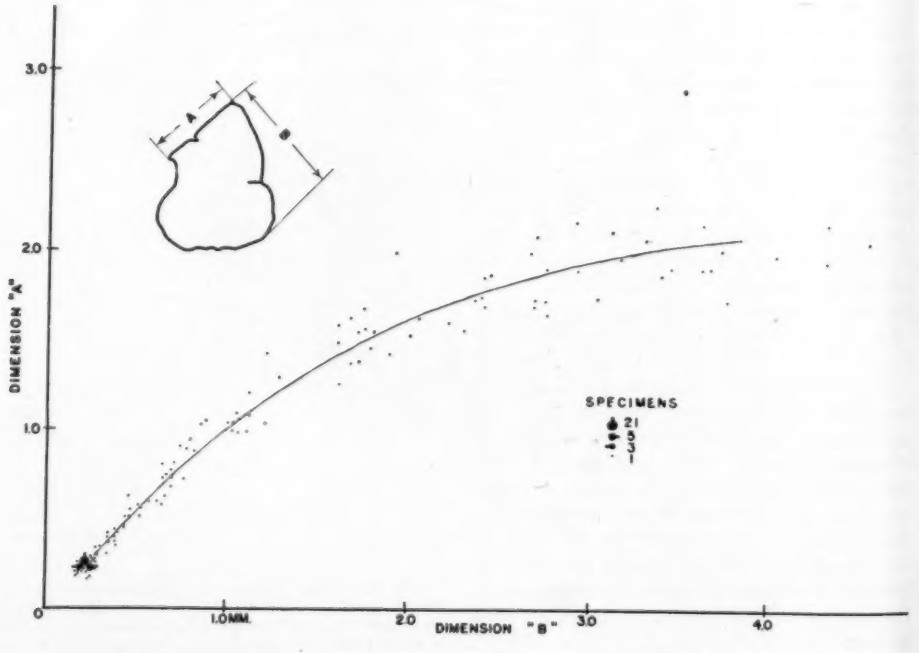

FIG. 7.—Bidimensional growth. A growth curve obtained by plotting lengths "A" and "B" on 2 axes. In all, 152 specimens (a mixed sample) were measured. Different areas, plotted separately, did not give a significant difference.

measured from the distal (carinal) notch of the mantle slit to the furthest corner of the horny knob (dimension "A"). The body diameter was measured perpendicular to the plane of the outside edge of the lip and knob to the opposite edge of the reproductive fan at the widest point (dimension "B"). The growth curve obtained by plotting these two measurements shows that the slit (dimension "A") grows rapidly at first during the juvenile stage, while the reproductive fan (dimension "B") grows markedly during adulthood. No grouping of the results is obtained, however, to warrant the designation of larval instars.

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TABLE 1.—ANALYSIS OF INFECTED AREAS

	Tegula funebralis Total shells	With barnacles	Per cent infected	*Tegula brunnea* Total shells	With barnacles	Per cent infected	Miscellaneous shells	With barnacles	Per cent infected	Total shells	Total shells with barnacles	Total per cent infected
Point Arena 2/24/52												
gran	162	3	2	49	7	14	6	0	0	217	10	5
hemp	3	0	0	8	2	25	0	0	0	11	2	18
hirs	56	4	7	8	0	0	2	0	0	66	4	6
sam	230	12	5	6	3	50	6	0	0	242	15	6
unkn	11	0	0	3	2	67	0	0	0	14	2	14
	462	19	14	74	14	19	14	0	0	550	33	6
Havens Neck 8/7/51												
gran	67	0	0	11	6	55	1	0	0	73	6	8
hemp	30	5	17	64	34	58	0	0	0	94	42	45
sam	38	2	5	3	0	0	2	0	0	43	2	5
unkn	14	0	0	12	3	25	2	0	0	28	3	11
	143	7	5	90	43	48	5	0	0	238	53	22
Moss Beach												
7/28/51	58	15	26	116	30	26	0	0	0	174	45	26
8/17 *Low* gran	4	0	0	98	18	18	0	0	0	102	18	57
rest	2	0	0	17	7	41	0	0	0	19	7	37
	6	0	0	115	25	22	0	0	0	121	25	21
High gran	1	0	0	18	3	17	0	0	0	19	3	16
sam	41	5	12	97	32	33	0	0	0	138	37	27
	42	5	12	115	35	30	0	0	0	157	40	25
Total	48	5	10	230	60	26	0	0	0	278	65	23
10/14/51	126	26	21	412	80	19	2	0	0	540	106	20
12/10 *Low*	10	0	0	239	56	24	2	0	0	251	56	22
High	27	4	15	167	52	31	0	0	0	194	56	29
	37	4	11	406	108	27	2	0	0	445	112	25

TABLE 1—*Continued*

	Tegula funebralis Total shells	With barnacles	Per cent injected	*Tegula brunnea* Total shells	With barnacles	Per cent infected	Miscellaneous shells	With barnacles	Per cent infected	Total shells	Total shells with barnacles	Total per cent infected
1/25/52 gran	14	0	0	401	52	13	3	1	33	418	53	13
sam	10	1	10	15	4	27	0	0	0	25	5	20
unkn	3	0	0	20	7	35	0	0	0	23	7	30
	27	1	37	436	63	14	3	1	33	466	65	14
3/9	104	16	15	485	78	16	4	0	0	593	94	16
4/6	99	12	12	382	41	11	5	0	0	486	53	11
7/8	120	23	19	135	29	21	0	0	0	255	52	20
Total	619	102	16	2602	489	19	16	1	6	3237	592	18
Monterey County, July 1951												
Point Pinos	528	90	17	127	20	16	1	0	0	656	110	17
Point Joe	27	8	30	40	10	25	0	0	0	67	18	27
Fan Shell Beach	26	9	35	20	7	35	1	0	0	47	16	34
Pescadero Point	18	0	0	12	3	25	2	2	100	32	5	16
Mission Point	25	1	4	5	0	0	0	0	0	30	1	3
	624	108	17	204	40	20	4	2	50	832	150	18
Piedras Blancas 8/5/51												
gran	131	23	18	162	97	60	1	0	0	294	120	41
sam	168	80	48	58	47	81	0	0	0	226	127	56
unkn	10	6	60	9	4	44	0	0	0	19	10	53
	309	109	35	229	148	65	1	0	0	539	257	48
Cayucas 9/16/51												
	278	54	19	9	0	0	2	0	0	289	54	19
Shell Beach 8/6/51												
gran	45	7	16	5	2	40	3	1	33	53	10	19
sam	60	28	47	6	2	33	2	0	0	68	30	44
	105	35	33	11	4	36	5	1	20	121	40	33
Total	1875	387	21	2278	608	27	24	4	17	4177	999	24.0

ABBREVIATIONS USED IN TABLE 1

ber—Pagurus beringanus.
gran—P. granosimanus.
hemp—P. hemphillii.
hirs—P. hirsutiusculus.
sam—P. samuelis.
unkn—Unknown.
* —Whelk type of shell.
† —Tegula ligulata.

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ZOOLOGY.—Polydora nuchalis, *a new species of polychaetous annelid from California.*[1] KEITH H. WOODWICK, Allan Hancock Foundation, University of Southern California. (Communicated by Waldo L. Schmitt.)

The spionid worm described herein is the tenth species of *Polydora* to be reported from California (for others see Hartman, 1941). Although resembling several other species in some characteristics, the worm is clearly and consistently different; it is therefore described as a new species.

Polydora nuchalis, n. sp.

The body is generally depressed; it is most so at the modified fifth segment where it is more than twice as wide as deep. It is less depressed in front of and behind this segment. The body tapers posteriorly just before the terminal flaring pygidium. The range observed in the number of segments is 80 to 110; in millimeters of length 15 to 20. In life this polydorid is translucent yellow in color, some individuals having a smoky surface pigmentation in the anterior two-thirds of the body and in the pygidial region. The palpi lack pigment granules but are colored bright red by the blood as are the middorsal and midventral lines and the branchiae of living specimens.

The prostomium is bifid anteriorly and extends posteriorly as the caruncle to the forward margin of the third setigerous segment [third segment below] (Fig. 1, b). A median nuchal tentacle, on which the specific name is based, arises from the prostomium at the level of the first segment. Two pairs of eye spots in a trapezoidal arrangement are found near the palpal bases. The posterior ones are closer together and slightly smaller than the anterior pair. The palpi are long and extend back to the twentieth segment in preserved specimens. The peristomium flares to each side of the prostomium; it is bounded above by the latter and in front and ventrally by the oral aperture.

The first segment lacks notosetae; the parapodia are represented by notopodial and neuropodial lobes and a neuropodial fascicle of setae (Fig. 1, a). The neuropodial lobe and setae are oriented on a line with the notopodial lobes of the succeeding segments. The short, first notopodial lobes are located dorsally just behind the palpal bases.

The next three segments have well-developed notopodial and neuropodial postsetal lobes and fascicles of long slender setae. The notopodial fascicle has two rows of setae including an anterior row of short limbate and a posterior one of longer capillary setae. This notopodial arrangement continues through segments 6 to 9. The neuropodia of segments 2 to 4 have capillary setae.

Segment 5 (Fig. 1, a) is larger than either the fourth or the sixth segment; it lacks postsetal lobes. Its notopodium has a bundle of anterior dorsal capillary setae and a slightly curved single series of large spines alternating with as many companion setae. The spines are largest anterodorsally and are gradually reduced in size posteriorly. They are weakly falcate in shape (Fig. 1, d); the companion setae are

[1] Contribution no. 119 from the Allan Hancock Foundation, University of Southern California, Los Angeles, Calif. This study was aided by the personnel and made possible through the use of the facilities of the Allan Hancock Foundation.

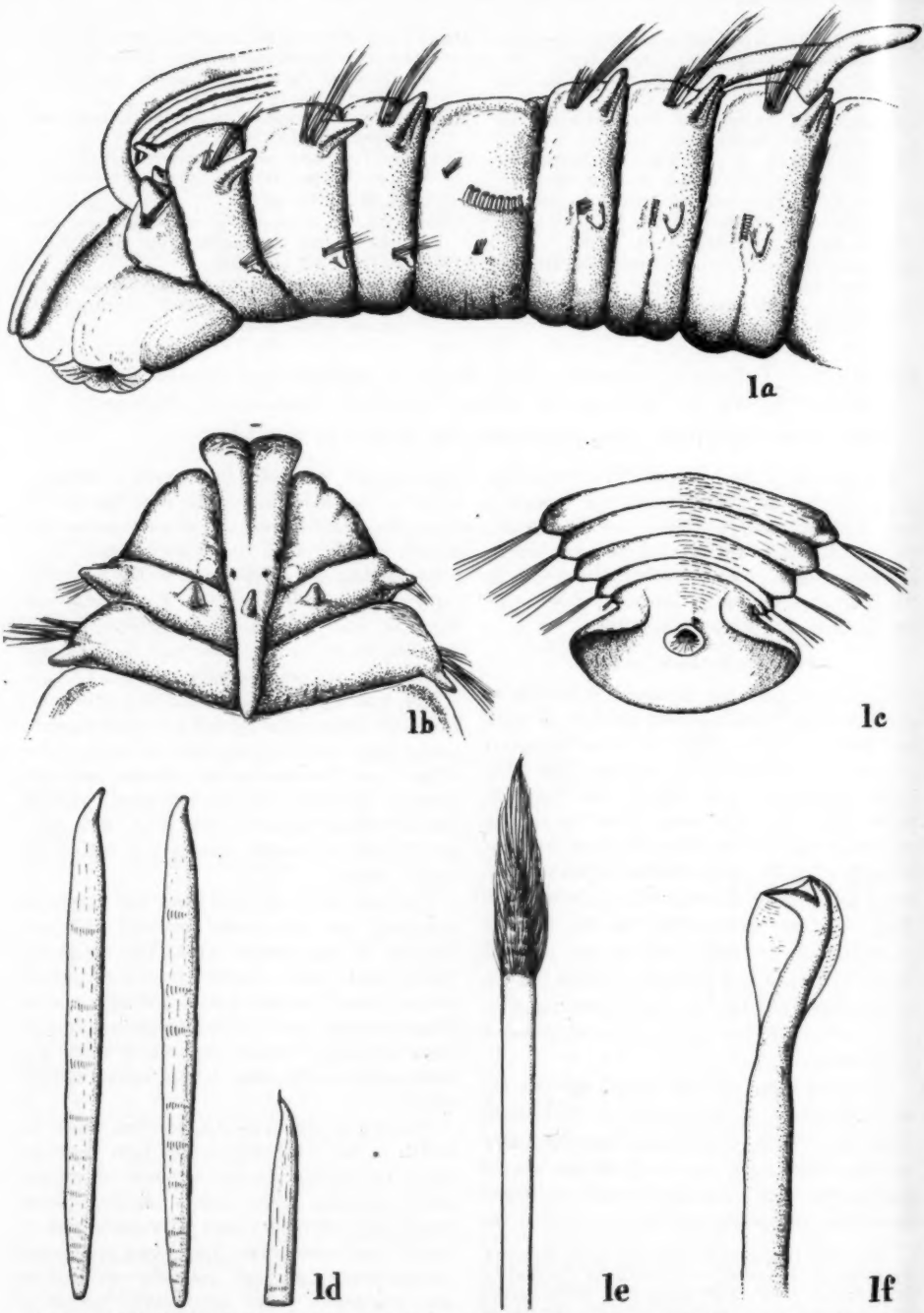

FIG. 1.—*Polydora nuchalis*, n. sp.: *a*, Anterior end, in left lateral view, × 53; *b*, anterior end, in dorsal view, × 53; *c*, pygidium, in posterior dorsal view, × 53; *d*, stout spines of the modified fifth segment showing new, worn, and developing spines, × 122; *e*, companion seta of the modified fifth segment, × 529; *f*, ventral hooded hook from the seventh segment, × 710.

plumose (Fig. 1, e). The neuropodium of segment 5 is vestigial; it has a fascicle of short capillary setae.

Segment 6 resembles segments 2 to 4. Segment 7 differs abruptly in having the beginning of the branchiae dorsally and the hooded hooks ventrally (Fig. 1, a). The vertical series of hooded hooks vary in number from 8 to 6; the anterior segments have the greater number. The hooks are distally bidentate. The main tooth forms an angle with the shaft of approximately 90° and an acute angle with the accessory tooth (Fig. 1, f). (See Söderström, 1920, p. 41, for method of angle measurement.) The notopodial lobes decrease in size from segment 7 to 15. They are small, papillar behind segment 15.

The branchiae are finger-shaped and overlap at the middorsal line. They are full-sized from segment 7 to the posterior fourth of the body There is a gradual reduction in size from this point. There are no specialized posterior notopodial spines or hooks. The pygidium is broad and flaring; it has a wide dorsal notch (Fig. 1, c). The anus is situated slightly dorsal of center.

This species resembles *Polydora cirrosa* Rioja (1943, pp. 233–238, figs. 8–25) in many characteristics but varies from it in the following features: (1) The caruncle extends only to the third instead of the fifth segment; (2) a neuropodial fascicle is present, not absent, in the fifth segment; (3) the notopodial lobes of the first segment and the median nuchal tentacle are short, never cirriform, even in mature specimens; (4) the stout spines and companion setae of the fifth, and the ventral hooded hooks are different.

Polydora nuchalis is also close to *Polydora ligni* Webster (1886, pp. 148–149, pl. 8, figs. 45–47) from which it differs by the following characteristics: (1) It lacks, instead of has, an accessory tooth on the stout spines of the modified segment; (2) the caruncle extends only to the third, instead of to the fourth, segment; (3) the hooded hooks differ.

It also resembles *Polydora websteri* Hartman (1943, pp. 70–72, figs. 1, a–h) but varies from it in that: (1) The caruncle extends only to the third, instead of to the fourth, segment; (2) it has a median nuchal tentacle; (3) the stout spines and companion setae of the fifth segment are different.

Holotype.—U.S.N.M. no. 24724, from Playa del Rey, Calif.

Distribution.—*P. nuchalis* occurs abundantly in the lagoon at Playa del Rey, Los Angeles County, Calif.

Biology.—The water of the lagoon at Playa del Rey varies considerably in salinity owing to alternate seasonal rains and evaporation. This species tolerates these varying salinities. It constructs mucus-lined tubes that are externally covered by a thin layer of sand; they penetrate the substratum to a depth of one or two inches. Associates in the lagoon are *Streblospio benedicti* Webster, *Capitella capitata* (Fabricius), and the amphipod *Corophium insidiosum* Crawford. A fiddler crab, *Uca crenulata* (Lockington), is abundant near the water's edge.

The eggs of *P. nuchalis* are deposited in transparent mucous capsules. The capsules are oriented in rosarylike chains and are individually attached to the wall of the tube by two strands which are continuations of the capsular material. Each capsule has as many as 100 eggs. Only one to eight of the eggs in each capsule develop into larvae; the remaining ova serve as food for the encased larvae. The latter ordinarily reach the 9–12 segmented stage before being freed from the capsule. A short planktonic life may precede settling and tube building.

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ZOOLOGY.—*A new species of polychaete worm of the family Ampharetidae from Massachusetts.* MAR H. PETTIBONE, University of New Hampshire, Durham, N. H. (Communicated by Fenner A. Chace, Jr.)

In working over the polychaetous annelids in the Woods Hole region, a new species of ampharetid was found in a salt pond—James Pond on Martha's Vineyard, Mass. It is referred to the genus *Hypaniola* Annenkova, which previously contained a single species, namely, *Hypaniola kowalewskii*, known from the Caspian Sea. *Hypaniola*, as well as the closely related *Hypania* Ostroumov and *Parhypania* Annenkova, includes species noted for their euryhaline properties. The new species is named in honor of Milton Gray, who collected the specimens. The types are deposited in the U. S. National Museum (no. 24734).

Family AMPHARETIDAE

Genus Hypaniola Annenkova, 1927; char. emend.

Type species: *Hypaniola kowalewskii* (Grimm, 1877) Annenkova, 1927, in Caspian Sea. Prostomium trilobed, with or without glandular crests (without in type species; a variable character depending on amount of folding?), with two eye spots. Retractile oral tentacles smooth (not pinnate). Paleae present but poorly developed, delicate, inconspicuous. Branchiae three or four pairs, fused basally. Without pair of dorsal hooks posterior to branchiae (as in *Melinna*). Notosetae begin on segment 3, present on 17 thoracic segments. Notopodia without cirri. Thoracic uncinigerous pinnules begin on segment 6 (setigerous segment 4). Thoracic uncini with a vertical row of teeth. Abdominal uncini with three vertical rows of teeth (type species) or a single row (*H. grayi*). Abdominal uncinigerous pinnules without cirri (type species) or with cirri (*H. grayi*). Pygidium without anal cirri. Nephridia 3 pairs, in segments 4–6 (setigerous segments 2–4).

Hypaniola grayi, n. sp.

Fig. 1, A–M

Size.—Length 9–15 mm., greatest width 1–1.5 mm.

Description.—Body inflated anteriorly, tapered gradually to a narrower posterior end (Fig. 1, A). Body wall thick, opaque, and distinctly segmented on ventral side; very thin, transparent, iridescent, and indistinctly annulated on dorsal side. Prostomium trilobed, the median lobe widest anteriorly, may be flat (in life, Fig. 1, E) or somewhat folded so as to form a more depressed median part and lateral longitudinal crests (Fig. 1, B); basal part a transverse raised area with a pair of lateral eyespots; lateral lobes encircle the median lobe laterally and posteriorly. First achaetous or buccal segment extended ventrally forming a rounded lobe under the prostomium, as long as the next three segments (Fig. 1, B–C). Oral tentacles may be completely retracted within the mouth or more or less extended; they are digitiform, smooth, up to 20 in number, in pairs arranged dorsoventrally on a somewhat folded tentacular membrane, longest and largest near midline, gradually becoming smaller and shorter laterally (Fig. 1, D).

Second or paleal segment with a raised ridge into which the prostomium and buccal segment may be partially withdrawn, the ridge being especially prominent middorsally (Fig. 1, B–C, F); with first pair of branchiae and weakly developed paired lateral bundles of paleal setae. Paleae in each bundle seven or eight in number, forming a spreading bundle, small, very delicate, iridescent, tapering gradually to slender capillary tips, as long as the thoracic notosetae but more delicate (easily overlooked). Segments 3–5 (thoracic setigerous segments 1–3) short, crowded, with cylindrical notopodia bearing notosetae, and with the next three pairs of branchiae. Branchiae four pairs, subequal, long, tapering, subulate, first pair on paleal segment, second pair more laterally on first setigerous segment, third pair more dorsally on second setigerous segment (second and third branchiae almost in transverse line due to crowding of setigerous segments 1–2), fourth pair on setigerous segment 3, in line with the first pair (Fig. 1, A–C, F). The bases of the four branchiae form a close group, with their basal portions distinct but fused to one another on the paleal segment.

Thoracic region with cylindrical notopodia containing bundles of notosetae on 17 segments (beginning on segment 3; Fig. 1, A, C, H–J). Notosetae widest basally, tapering gradually

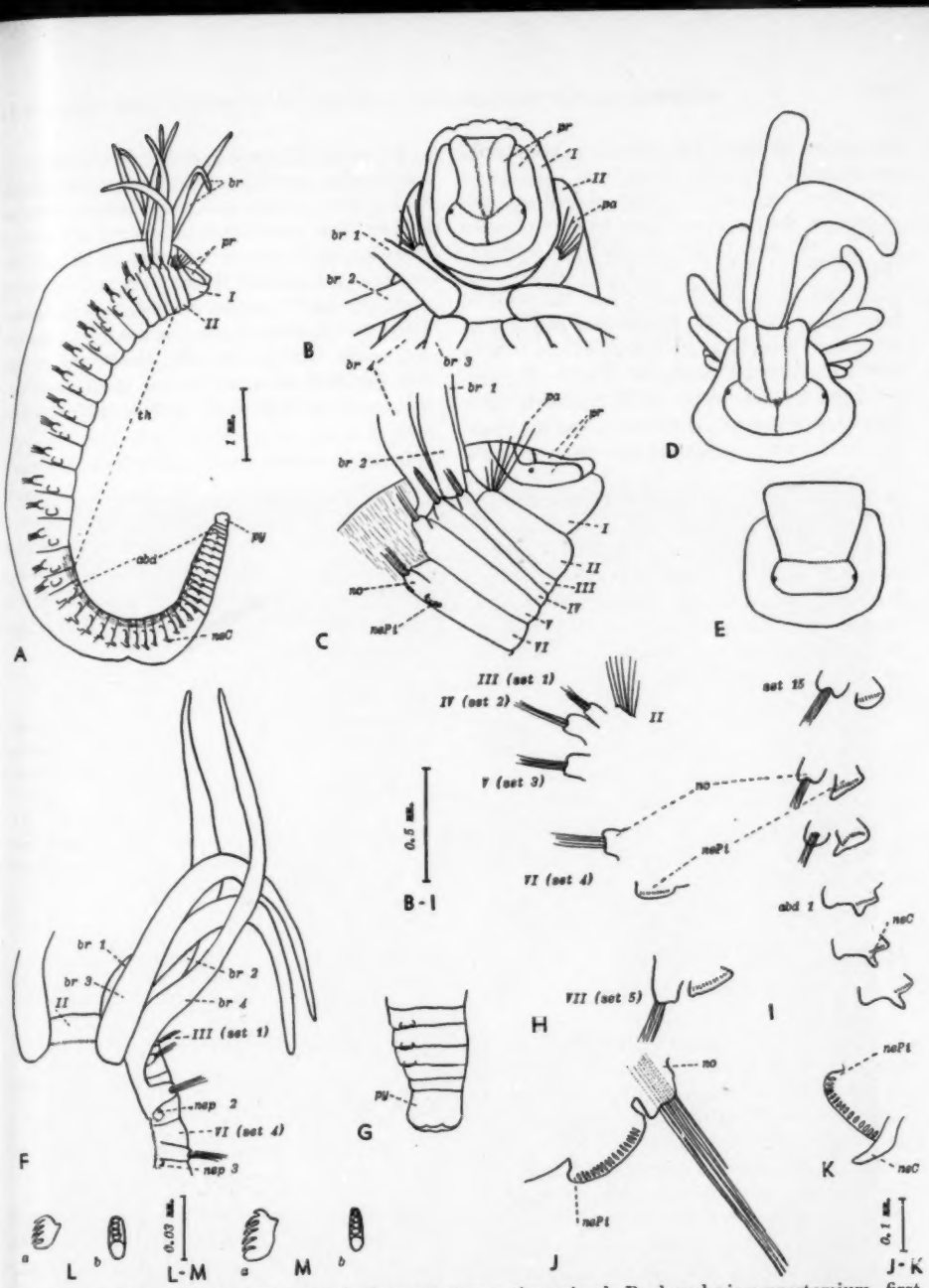

FIG. 1.—*Hypaniola grayi*, n. sp.: A, Lateral view entire animal; B, dorsal view prostomium, first two segments, and bases of branchiae; C, lateral view anterior end, with bases of branchiae only shown; D, dorsal view prostomium and extended oral tentacles; E, dorsal view prostomium (sketched in life); F, dorsal view right group of branchiae and first few thoracic segments; G, lateral view posterior end; H, parapodia of first few segments from right side; I, parapodia of last few thoracic segments and first few abdominal segments from right side; J, parapodium from thoracic region; K, parapodium from abdominal region; L, thoracic uncinus, (*a*) lateral view, (*b*) frontal view; M, abdominal uncinus, (*a*) lateral view, (*b*) frontal view. (*abd*, abdominal uncinigerous segment; *br*, branchia; *neC*, neuropodial cirrus; *nep*, nephridial papilla; *nePi*, neuropodial uncinigerous pinnule; *no*, notopodium; *pa*, paleal setae; *pr*, prostomium; *py*, pygidium; *set*, setigerous segment; *th*, thoracic setigerous segment; *I*, first or buccal segment; *II*, second or paleal segment; *III*, third or first thoracic setigerous segment, etc.)

to slender capillary tips. Thoracic neuropodial uncinigerous pinnules begin on segment 6 (setigerous segment 4); pinnules without cirri or may be short cirri on upper parts of pinnules on few of more posterior thoracic segments (Fig. 1, H–I). Thoracic uncini pectiniform, with four teeth in a single row above the rounded basal part (Fig. 1, L). Abdominal region with achaetous remnants of notopodia on about first six abdominal segments (Fig. 1, I), with uncinigerous pinnules on 22–25 segments (may have one or two achaetous posterior rings; Fig. 1, G), with neuropodial cirri on upper parts of pinnules (Fig. 1, I, K); abdominal uncini pectiniform, with five teeth in single row above rounded basal part (Fig. 1, M). Pygidium short, rounded, without papillae or cirri, may be somewhat lobulated (Fig. 1, G). Anus terminal. Posterior end, including pygidium and last few uncinigerous segments, may be turned inside. Nephridial papillae 3 pairs, posterior to notopodia on segments 4–6 (setigerous segments 2–4; Fig. 1, F).

Color: in life, greenish with whitish spots; in alcohol, colorless or slightly brownish. Tube several times the length of the animal, rather straggly, composed of debris and few light-colored sand grains or may be composed mostly of light-colored sand grains and a small amount of debris.

Remarks.—*Hypaniola grayi* differs from *H. kowalewskii* (Grimm, 1877; see Annenkova, 1927, 1929; known from the Caspian Sea) as follows: The prostomium is shaped differently; there are four pairs of subequal branchiae (*H. kowalewskii* has three or four pairs of branchiae; when the fourth pair is present, it is rudimentary); the abdominal pinnules have cirri (without in the Caspian species); abdominal uncini with five teeth in a vertical row (in *H. kowalewskii*, uncini with 15 or 16 teeth in three vertical rows).

Locality.—James Pond (salt pond), Martha's Vineyard, Mass., found by digging in sandy mud under water, collected by M. B. Gray, August 8, 1950, August 25, 1951, and August 21, 1952. It was found along with other polychaetes, as *Haploscoloplos fragilis* (Verrill), *Heteromastus filiformis* (Claparède), and *Polydora ligni* Webster.

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MALACOLOGY.—*Review of the living species of* Echinochama. DAVID NICOL, U. S. National Museum.

A few months before the publication of my paper on *Echinochama* (1952), I received 10 specimens of the genus from Dr. H. S. Lopes, of the Instituto Oswaldo Cruz, Rio de Janeiro, Brazil, and Dr. C. N. Gofferjé, of the Museu Paranaense, Curitiba, Brazil. The material was collected on the coast of the State of Santa Catarina, Brazil. Besides the fact that these specimens extend the recorded range of the genus considerably, they are also distinctive enough morphologically to be considered a heretofore undescribed species. This paper contains a description of the new species and a review of the living species of the genus as well as its geographic distribution.

Genus **Echinochama** Fischer, 1887

Type species.—(Monotypy) *Chama arcinella* Linné, 1767. Recent, Caribbean Sea.

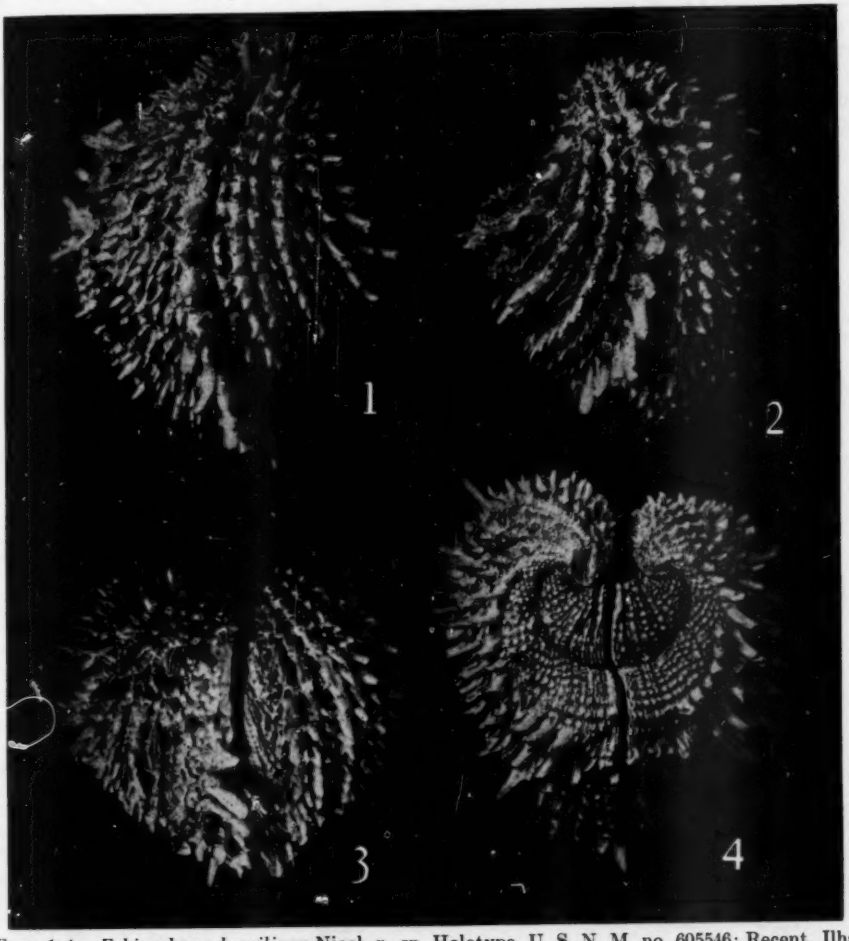
Echinochama brasiliana Nicol, n. sp.

Figs. 1–4

Description.—Shell thick, large; generally higher than long; ratio of convexity to height 0.80; number of spine rows from 18 to 29, averaging 24 for 10 specimens; spine rows closely spaced and most spines small and closely spaced; largest specimen 61.6 mm high, 54.3 mm long, convexity 52.6 mm; smallest specimen 40.5 mm high, 39.7 mm long, convexity 32.0 mm; average height 51 mm, average length 46 mm, average convexity 41 mm.

Comparisons.—*Echinochama brasiliana* is most closely related to *E. arcinella arcinella* but differs from the latter in the following ways: It is larger and has a thicker shell; it is more obese (ratio of convexity to height 0.80 in *E. brasiliana* as compared with 0.75 in *E. arcinella arcinella*); the spine rows are more numerous, and there are more and smaller spines on each row in *E. brasiliana*; the height and length are about equal in *E. arcinella arcinella*, whereas *E. brasiliana* is higher than long. *E. brasiliana* differs from *E. arcinella californica* in the same ways. *E. brasiliana* differs from *E. cornuta* in having a larger number of rows of spines (average 24 as compared to average 10 in *E. cornuta*); *E. brasiliana* also has more numerous small spines.

Types.—The holotype is in the U. S. National Museum, no. 605546; one lot containing two paratypes, no. 603965, and one lot containing one paratype, no. 605771, are also in the U. S. National Museum. Five paratypes have been sent to the Museu Paranaense, Rua Buenos Aires, 200-Curitiba, Paraná, Brazil, and one paratype has been sent to the Instituto Oswaldo Cruz, Rio de Janeiro, Brazil.



FIGS. 1–4.—*Echinochama brasiliana* Nicol, n. sp. Holotype, U. S. N. M. no. 605546; Recent, Ilha do Francês, Santa Catarina, Brazil; × 1; 1, Exterior view, right valve; 2, exterior view, left valve; 3, posterior view, both valves; 4, anterior view showing lunule, both valves.

KEY TO THE RECENT SPECIES OF ECHINOCHAMA

1 Average number of spine rows 10..*E. cornuta*
Average number of spine rows 20 or more..2
2(1) Height and length equal, umbones low, spines generally large.....*E. arcinella*
Higher than long, umbones high, many rows of small spines.....*E. brasiliana*

Geographic distribution.—The new species occurs at the extreme southern end of the range of *Echinochama* in the western Atlantic, and it has been found only off the Ilha do Francês, which is 1,200 meters north of Ilha de Santa Catarina, Santa Catarina, Brazil. According to Dr. Gofferjé (1950, p. 262, and also personal communication), *E. arcinella arcinella* is found on the coast of Paraná, Brazil. Additional collecting may extend the range of the genus still farther south. The accompanying map (Fig. 5) shows the distribution of the living species of *Echinochama*, and a more detailed account of the distribution of the genus is given in my paper (1952, pp. 811–813).

ACKNOWLEDGMENTS

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FIG. 5.—Map showing distribution of living species of *Echinochama*. Hexagons—*Echinochama cornuta* (Conrad). downward pointing triangles—*Echinochama arcinella arcinella* (Linné). Upward pointing triangles—*Echinochama arcinella californica* Dall. Squares—*Echinochama brasiliana* Nicol.

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